IMPERIAL INSTITUTE
OF
AGRICULTURAL RESEARCH, PUSA.

# JOURNAL

OF

# THE PROCEEDINGS

OF

# THE LINNEAN SOCIETY.

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## BOTANY.

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VOL. VI.

LONDON:
SOLD AT THE SOCIETY'S APARTMENTS, BURLINGTON HOUSE;
AND BY
LONGMAN, GREEN, LONGMANS AND ROBERTS,
AND
WILLIAMS AND NORGATE.
1862.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.

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JOURNAL OF THE PROCEEDINGS

OF THE

LINNEAN SOCIETY OF LONDON.

# On the Vegetation of Clarence Peak, Fernando Po; with Descriptions of the Plants collected by Mr. GUSTAV MANN on the higher parts of that Mountain. By J. D. HOOKER, Esq., M.D., F.R.S., F.L.S., &c.

[Read March 7th, 1861.]

A KNOWLEDGE of the temperate flora of any spot on the west coast of Tropical Africa has long been one of the greatest desiderata in botanical geography, not only on account of the intrinsic interest that must attach to the plants of the extremely few isolated points so elevated as to possess a temperate climate in that vast humid and torrid area, but also from the light such plants might be expected to throw on the floras of St. Helena, the Cape de Verd, and the Canaries; all of which (and especially the former) contain peculiar endemic genera, whose nearest allies might be expected to exist on the mountains of the neighbouring continent.

Within the last year the outlines of such a desiderated flora have been supplied by the energy and resolution of Mr. Gustav Mann, of the Royal Gardens, Kew, who was appointed by Lord John Russell (Foreign Minister) to succeed the late lamented Barter, as botanist to Dr. Baikie's Niger Expedition, but who, being unable to ascend the river and join that expedition, has devoted a year and a half to exploring the island of Fernando Po, and has twice reached its lofty summits, 10,700 feet above the sea; on both occasions collecting indefatigably and preserving his collections well.

Mr. Mann's account of the first of these ascents has already been read before the Society; he commenced the expedition on the 23rd March, 1860, and reached the summit on the 3rd April, where the temperature fell to 39° at night. The return was accomplished on the 13th of the same month. A second ascent was attempted on the 7th of November, and after eighteen days he had nearly reached the top, when his men rebelled, and he was obliged to return to Clarence. He started a third time, and reached the summit in December, but the dates and detailed narrative of this ascent have not yet arrived.

The following notes chiefly refer to the temperate plants, all but one of which (*Sanicula Europœa*) were collected at or above 5000 feet elevation. They amount to 76 species (in 66 genera), a singularly small number for 5700 feet of vertical height almost under the equator. Of these fully 20 are tropical types that ascend a little above 5000 feet, and must be excluded from the temperate flora. The remaining 56 belong to no fewer than 45 genera; proving the flora to be an extremely fragmentary one.

Of the total 76, 37 are Abyssinian species, and 16 others closely allied to such; and of the 56 temperate, 32 are also natives of the mountains of Abyssinia, most of them being absolutely specifically identical, and others but slightly differing; such differences being in some cases doubtless apparent rather than real, and owing to the want of a larger suite of specimens; 13 others also are very closely allied to Abyssinian species.

Again, of the Abyssinian mountain plants common to Clarence Peak, no fewer than 17 are absolutely peculiar to these two localities as far as is at present known, including some very remarkable plants; as

Clematis Simensis
Thalictrum rhynchocarpum
Sagina Abyssinica
Trifolium subrotundum
—— Simense
Helichrysum chrysocoma
—— Hochstetteri
—— globosum
Blæria spicata
Stachys aculeolata, n. sp.
Pycnostachys Abyssinica
Calamintha Simensis
Cyanotis Abyssinica?
Kyllingia macrocephala
Trisetum lachnanthum
Festuca Schimperiana
Gymnandropogon, sp.

Besides these are the following, which are not found south of Abyssinia in Africa:—

Galium rotundifolium
Parietaria Mauritanica
Deschampsia cæspitosa
Brachypodium sylvaticum.

Others are common to Abyssinia, the Mauritius, Madagascar, &c.: as

Viola Abyssinica
Hypericum angustifolium
Geranium Simense
Rubus apetalus
Carex Boryana.

There are, again, other species whose only near affinities are with Abyssinian: as species of

Agrocharis
Gymnosciadium?
Dichrocephala
Swertia
Plectranthus
Veronica
Euphorbia
Habenaria.

Extending the comparison to genera, I find that of the 66 Clarence Peak genera only 7 are not Abyssinian, and of the 45 temperate genera 41 are temperate Abyssinian. Of the 3 remaining, *Luzula* and *Schœnus* may yet be found in Abyssinia, and *Leucothoe* is a Mauritius plant.

The next affinity is with Mauritius, Bourbon, and Madagascar: of the whole 76 species, 16 inhabit these places, and 8 more are closely allied to plants from there. Three temperate species are peculiar to Clarence Peak and the East African Islands, including *Leucothoe angustifolia*, *Sebæa brachyphylla*, and *Carex Wahlenbergiæ*. *Ericinella* and *Leucothoe* are the only genera not Abyssinian, which are common to these islands and to Fernando Po.

Lastly, if compared with the Cape, the contrast is very striking: not only is there a total want of any true Cape types, except such few as are common to Abyssinia or the Eastern African Islands (5 species), but only 12 of the 76 Fernando Po species are known to be South African; and of these all but *Luzula* have been also found in Abyssinia. Only 12 others are nearly related to South African forms. Turning to the genera, *Peddiea* is the only peculiarly South African one; and this is not temperate at Fernando Po, and is subtropical in South Africa.

Hence the result of comparing the Clarence Peak flora with that of the African continent is—1. The intimate relationship with Abyssinia, of whose flora it is a member, and from which it is separated by 1800 miles of absolutely unexplored country*; 2. the curious relationship with the East African Islands, which are still further off; 3. the almost total dissimilarity from the Cape flora.

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* This result is strongly in favour of the existence of a chain of mountains crossing Central Africa, from Abyssinia to the Cameroons Mountains, of whose probable existence M. du Chaillu has recently procured evidence.

With the West African Islands again, contrary to my expectations, there is no marked relationship whatever, except obscurely with St. Helena through *Wahlenbergia arguta*: the arborescent *Compositæ* and *Lobeliaceæ, Phylicæ, Melhaniæ, Frankenia, Acalypha,* and frutescent *Heydotis* of St. Helena, being wholly unrepresented in Fernando Po.

Taking a still wider range, the temperate flora of Fernando Po belongs to the northern hemisphere. Of the 48 temperate genera, 12 only are not European; whilst the following species are European, and most of them British:—

Oxalis corniculata
Sanicula Europæa
Galium Aparine
—— rotundifolium
Limosella aquatica
Parietaria Mauritanica
Luzula campestris
Deschampsia cæspitosa
Brachypodium sylvaticum.

The two following are also probably states of European plants:—*Ranunculus pinnatus*, very near *R. philonotis*; *Calamintha Simensis*, near *vulgaris.*

### RANUNCULACEÆ,

Of this Order, which is very far from well-represented, even in the temperate and alpine regions of Tropical and Southern Africa, three genera, each containing a single species, were collected by Mr. Mann on Clarence Peak. All are Abyssinian; one only, and that a plant of very wide distribution, is South African also.

1. Clematis Simensis, *Fresen*; *Rich. Fl. Abyss.* i. 3.

*Hab.* In Clarence Peak, alt. 4–8000 ped. (fl. Nov.)—Alte scandens, 120-pedalis! Flores albi.

The flowers are a little smaller than the Abyssinian specimens. A. Richard describes this species as glaucous in all its parts, but such is not the case in all our authentically named specimens, nor in these from Fernando Po, which have also more membranous foliage; such differences are what the more humid climate of West Tropical Africa would lead us to expect. The lower parts of the filaments are also rather more silky in Mann's specimens, but this is a variable character. I have no fruiting individuals. This species is found throughout Abyssinia at 8000 feet elevation.

2. Thalictrum rhynchocarpum, *Quart. Dill. & Rich.*; *Rich. Fl. Abyss.* i. 3.

*Hab.* In Clarence Peak, alt. 10,000 ped.

*Herba* 12-pedalis. Fl. virides. Stamina numero varia, interdum plurima.

A most remarkable species, and quite unlike any other hitherto described. A. Richard rightly characterizes it as one of the best-marked species of the genus. Mann's specimens are in flower only, and have the pinnules sometimes a little more divided than in Abyssinian ones; it is not uncommon in mountain woods of Abyssinia.

3. Ranunculus pinnatus, *Poir.*, var. *extensa* carpellis lævibus.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Caules* graciles, elongati, flexuosi, interdum ad nodos radicantes. *Folia* longe et gracile petiolata, pinnata v. biternata, foliolis longe petiolulatis.

This in every respect agrees with *R. pinnatus,* Poir, of Southern Africa, except in its more drawn-out habit (a feature doubtless attributable to the climate of Fernando Po), and the total absence of any tubercles on the carpels. This last, however, is a variable character, and often wanting in the very closely allied *R. philonotis,* Retz., of Europe, which, with the present and some other plants of India and America, will, I suspect, ultimately prove to belong to one collective, widely diffused species.

## MENISPERMEÆ.

1. Stephania hernandifolia, *Wall.*; *H.f. & T. Flor. Ind.* i. 196. cum Syn.

*Hab.* In Clarence Peak, alt. 3–5000 ped. (fl. Dec.)

Identical with the Indian plant, which is also a native of various parts of Tropical and Southern Africa, Java, and Australia.

## VIOLARIEÆ.

1. Viola Abyssinica, *Steud.*, var. *impunctata.*

*Hab.* In Clarence Peak, alt. 10,000 ped. (fl. April.)

*Caules* repentes, elongati, hic illic radicantes. *Folia* impunctata. *Flores* pallide purpurei.

Except in wanting the oblong brown maculæ on the foliage, I can find no distinction whatever between this and the plant of Abyssinia, where as at Fernando Po, it grows in the region of heaths. It is also found in Madagascar with unspotted foliage.

## PITTOSPOREÆ.

1. PITTOSPORUM MANNII, *H.f.* Foliis elliptico-lanceolatis utrinque attenuato-acuminatis margine undulatis, paniculis ramosis multifloris puberulis, floribus parvis, capsula parva latissime obovoidea.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Frutex* 20-pedalis. *Folia* petiolata, glaberrima, 2½″–3½″ long., utrinque viridia, glaberrima. *Panicula* subpyramidalis, 1½″ long., erecta, ramis erecto-patentibus. *Flores* ⅛″ long., flavi; sepalis basi connatis, acutis, glabriusculis petalis obtusis dimid. brevioribus; ovario staminibusque glaberrimis. *Capsula* (unica tantum visa) ¼″ long., ⅓″ lata, basi abrupte angustata, apice retusa.

Allied to *P. Abyssinicum,* Hochst., which has generally obtuse leaves; and more closely still to the Mauritius *P. Senacia,* Putt., but differing from both in the erect paniculate inflorescence, smaller flowers and very different capsule.

### CARYOPHYLLEÆ.

1. Sagina Abyssinica, *Hochst.*; *Rich. Fl. Abyss.* i. 47.

*Hab.* In Clarence Peak, alt.? (fl. Dec.)

This is absolutely identical with the Abyssinian plant, and is a very distinct species from any other. The flowers are often tetramerous. The only other Fernando Po plant of this order is *Drymaria cordata*, W., which grows at low levels.

### HYPERICINEÆ.

1. Hypericum angustifolium, *Lamk.*; *DC. Prodr.* i. 545.

H. leucoptychodes, *Steud.*; *Rich. Fl. Abyss.* i. 96.

*Hab.* In Clarence Peak, 7–10,000 ped. copiosissime. (fl. Dec.)

*Arbuscula* 30-pedalis. *Folia* interdum et sepala secus marginem punctata, sæpius omnia impunctata.

The Bourbon specimens of this noble plant have the leaves rather narrower than the Abyssinian, and wholly impunctate. In both the Fernando Po and Abyssinian specimens, the calyx and leaves have sometimes the margins punctate. The leaves of the Fernando plant are in some specimens like the Abyssinian, in others like the Bourbon. It is a very common tree in the mountains of Abyssinia.

### GERANIACEÆ.

1. Geranium Simense, *Hochst.*; *Rich. Fl. Abyss.* i. 116.

G. Emirnense, *Hils. & Bojer*, MSS. in *Hb. Hook.*

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Ap.–Dec.)

Mr. Mann's specimens are identical with Bojer's Madagascar *G. Emirnense*, and with some of Schimper's Abyssinian *G. Simense*, which A. Richard describes as a very variable plant, and common in the cold regions of Abyssinia.

### BALSAMINEÆ.

This order is probably common in the hilly regions of Tropical Africa, whence I have seen about a dozen species. Only one, however, is described as Abyssinian, and one South African. I shall here describe four Fernando Po species, of which only one ascends to 5000 feet, and none have been found above that elevation. I have referred these to the sections adopted in the monograph of the East Indian species, published in the fourth volume of this Journal. They are as follows:—

1. UMBELLATÆ. Folia alterna. Flores ad apicem pedunculi elongati congesti v. dense racemosi.
2. UNIFLORÆ. Folia alterna. Pedicelli in axillis foliorum solitarii v. fasciculati, uniflori.
3. LATERIFLORÆ. Folia alterna. Flores racemosi, racemi foliis breviores v. axillis foliorum inferiorum dispositi.

1. IMPATIENS (UMBELLATÆ) FILICORNU, *H.f.* Foliis longe petiolatis,

late ovatis acutis setoso-crenatis, pedunculis elongatis gracillimis, apice floriferis, bracteis imbricatis cymbiformibus caducis, sepalis lateralibus obtusis, vexillo erecto late oblongo, labello planiusculo, calcare strictiusculo gracillimo alis æquilongo instructo.

*Hab.* In Clarence Peak, alt. 5000 ped. (fl. Dec.)

*Herba* tota glaberrima, pedalis; caule gracili simplici. *Folia* alterna, sub 2″ long., petiolis æquilonga, membranacea. *Pedunculi* laterales folia superantes, gracillimi, apices tantum floriferi, et ibi bracteis delapsis cicatricati. *Bracteæ*, ⅓″ long., obtusæ. *Pedicelli* gracillimi, ¾″ long., erecti. *Flos* pallide purpureus, 1″ diamet. planus. *Alæ* bilobæ, lobo laterali brevi obtuso, terminali oblongo obtuso.

This has very much the habit of the Ceylon *I. subcordata*, Arn.

2. IMPATIENS (UNIFLORÆ) MANNII, *H.f.* Caule gracili basi repente, foliis subdistantibus gracile petiolatis, petiolo glanduloso, ovatis acuminatis basi attenuatis setuloso-crenatis, pedicellis 1–2-axillaribus gracilibus ebracteolatis 1-floris, sepalis lateralibus parvis, vexillo mediocri, labello late conico calcare gracili curvo, alis longe gracile petiolulatis, lobo laterali unciformi parvo, terminali lato.

*Hab.* In Fernando Po, alt. 4000 ped. (fl. Dec.)

*Herba* 2–3′-pedalis, glaberrima, gracilis. *Folia* 2–3″, petiolo, ½″–1″, glandulis gracilibus ornato. *Pedicelli* graciles, petiolis breviores, fructiferi deflexi. *Flores* pulcherrimi, "rubidi" (*Mann*), sicco violacei, labello transverse fasciato. *Alæ* cum ungue gracili fere 1″ longæ.

3. IMPATIENS (UNIFLORÆ) BICOLOR, *H.f.* Suffruticosa, foliis confertis petiolatis elliptico-lanceolatis obtusis v. acuminatis basi attenuatis grosse setuloso-crenatis, pedicellis unifloris in axillis foliorum solitariis v. confertis ebracteolatis, vexillo parvo erecto, labello amplo late saccato basi in cornu valido ascendente incurvato contracto, alis parvis late oblongis obtusis.

*Hab.* In Fernando Po, alt. 4000 ped. (fl. Dec.)

*Herba* 2–3-pedalis, caule basi lignoso robusto, nodoso, superne cicatricato. *Folia* versus apices caulis conferta, patentia, 4–6″ long. in petiolum 1″ long. angustata, subcarnosula. *Flores* conferti, perplurimi (v. rarius pauci), bicolores, pedicellis 1″ long., sæpissime liberis, interdum in pedicellum brevem fasciculatis. *Sepala lateralia* parva, viridia. *Vexillum* flavo-virens $\frac{4}{3}$″ long., erectum. *Labellum* purpureum. *Alæ* longitudine oris labelli, flavæ purpureo lineatæ.

4. IMPATIENS (LATERIFLORÆ) HIANS, *H.f.* Foliis alternis longe petiolatis ovatis acuminatis basi rotundatis longe setosis setuloso-crenatis, racemis ex axillis inferioribus ortis, bracteis ovato-lanceolatis persistentibus, floribus magnis hiantibus, vexillo amplo erecto orbiculato dorso alato, labello demisso longe crasse conico stricto ore valde obliquo, alis linearibus.

*Hab.* In Fernando Po, alt. 2000 ped. (fl. Dec.)

*Herba* gracilis, erecta, glabra, 2½-pedalis, caule simplici basi radicante.

*Folia* membranacea, glaberrima v. superne sparse pilosa, 2½"–4" long., basin versus utrinque setis ½"–¼" longis filiformibus 1–2 ornata; petiolo 1" long. *Pedunculi* foliis breviores, patentes, 2–6-flori. *Flores* gracile pedicellati, rubri, bilabiati. *Sepala lateralia* viridia, ¼" long. *Vexillum* ¾" lat., dorso late alatum. *Labellum* 1½" long. *Alæ* ore labelli subæquantes, v. paulo superantes. *Capsula* linearis.

There is another species of *Impatiens* in the Herbarium, but in too imperfect a state for description.

### Nat. Ord. OXALIDEÆ.

1. Oxalis corniculata, *L.*

*Hab.* In Clarence Peak, alt. 8500 ped.

### Nat. Ord. OCHNACEÆ.

1. GOMPHIA MICRANTHA, *H.f.* Glaberrima, foliis lanceolatis acuminatis serrulatis utrinque nitidis venis remotis arcuatis, racemis terminalibus elongatis paucifloris vix ramosis folio brevioribus, floribus minutis remote fasciculatis glaberrimis.

*Hab.* In Clarence Peak, alt. 5000 ped. (fl. Nov.)

*Frutex* 15-pedalis. *Rami* graciles, virgati, teretiusculi. *Folia* breve petiolata, 4–6" long., membranacea, utrinque concolora. *Racemi* gracillimi, pauciflori. *Flores* breviter pedicellati, 1''' longi. *Calyx* brunneus, foliolis oblongis. *Petala* rufa.

### LEGUMINOSÆ.

The three plants of this family which have been found above 5000 feet, are all essentially temperate forms—one *Cytisus*, typical of the Mediterranean region and Canary Islands, but hitherto unknown in Tropical Africa, and known by one species only in Abyssinia: the others belong to *Trifolium*, also a Mediterranean genus, but several species of which are Abyssinian, including both the Fernando Po ones.

1. CYTISUS MANNII, *H.f.* Sericeo-pilosa, ramulis divaricatis villosis, foliis parvis brevissime petiolatis stipulis subulatis, foliolis elliptico-lanceolatis involutis, floribus ad apices ramulorum confertis sessilibus, calycis labio superiore late bifido.

*Hab.* In Clarence Peak, alt. 9000 ped. (fl. Dec.)

*Frutex* 5–6-pedalis, ramis lignosis, ramulisque divaricatis teretiusculis. *Folia* solitaria et fasciculata, ¼" long., stipulis subulato-lanceolatis petiolo adnatis, foliolis acutis 1½''' long. *Flores* flavi, ⅛" expans. *Calyx* bilabiatus, sericeus, labio superiore late bifido lobis acuminatis, inferiore apice trifido, lobis subulatis. *Vexillum* orbiculatum dorso sericeum. *Alæ* carinam obtusam genitalia includentem æquantes. *Staminum* tubus integer. *Ovarium* hirsutulum; stylo gracili mediocri; stigmate fere terminali; ovulis paucis.

2. Trifolium subrotundum, *Steud. & Hochst.*; *A. Rich. Flor. Abyss.* i. 172. *Var.* stipulis majoribus.

*Hab.* In Clarence Peak, alt. 9000 ped. (fl. Dec.)

*Herba* diffusa, 1–2-pedalis, corolla rubra.

A common Abyssinian plant, cultivated as horse-forage according to Dr. Roth (Herb. Hook.). The Fernando Po specimens differ in having larger stipules (¾" long.) than the Abyssinian, in which, however, they are very large for the genus (nearly ½"): in habit, foliage, inflorescence and flowers they are identical.

3. Trifolium Simense, *Fresen*; *A. Rich.*, l. c. 171.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Herba* 1½' alt., corolla violacea.

Very similar, as A. Richard indicates, to *T. subrotundum*, but well distinguished by the calyx, very narrow leaflets, and short petioles. The stipules terminate in a long filiform appendage, both in the Fernando Po and Abyssinian specimens.

## ROSACEÆ.

1. Rubus apetalus, *Poir.* *Var.* glabrior petalis parvis instructa.

*Hab.* In Clarence Peak, alt. 7000 ped. (fl. Nov.)

Scandens 12–15-pedalis. *Petala* alba, valde caduca.

This is clearly a form of *R. apetalus* of Bourbon, of which I have examined a Bourbon specimen gathered by Carmichael. Another form of it, sometimes bearing petals, and otherwise differing in having glabrous carpels, is found in Madagascar. A third, always petaliferous, is the *R. exsuccus*, Steud., of Abyssinia, which is described by A. Richard (Fl. Abyss. i. 256) as having the fruit entirely dry, but of which Dr. Roth remarks, "Berries eatable" (MS. in Hb. Hook.). Dr. Kirke, who has gathered the latter species in the Shirà Mountains (Livingstone's Exped., 1860), says, "Fruit good, exactly like the bramble, but small." The Fernando Po specimens are are not in fruit. This species has not been found in South Africa.

## UMBELLIFERÆ.

1. Sanicula Europæa, *L.*

*Hab.* In Fernando Po, alt. 4000 ped. (fl. Nov.)

I should suspect some error in the low elevation assigned by Mr. Mann to this plant, were his specimens not so carefully ticketed in other cases that I have every reason to put confidence in this. A. Richard gives *S. Europæa*, var. *Capensis*, as a native of Abyssinia; he does not, however, say what the characters of that variety are, and adds that his specimens are identical with Parisian. This plant has a very wide range in the mountainous regions of both Americas and Asia, and is also found in South Africa.

2. AGROCHARIS GRACILIS, *H. f.* Caule elongato ramoso foliisque hispidulo-pilosis, foliis gracile petiolatis bipinnatisectis segmentis lanceolatis acutis incisis, pedunculis elongatis sub apices patentim hispidis pilis flexuosis, floribus dense congestis.

*Hab.* In Clarence Peak, alt. 7000 ped. (fl. Dec.)

*Herba* gracilis, 4-pedalis, *A. melananthæ* (Abyssiniæ) quam maxime affinis, differt caule gracili elongato ramoso, foliis magis pilosis, capi-

tulis minoribus densius congestis, pedunculisque apices versus patentius pilosis pilis laxioribus flexuosis.

It is with some hesitation that I venture to describe this plant as different from the Abyssinian, fearing the characters depend wholly on locality. This curious genus is allied to *Daucus*, and the Abyssinian is the only previously described species.

3. Gymnosciadium ? ?

*Hab.* In cacumine Clarence Peak, alt. 10,000 ped.

*Herba* pilosa, radice valida insapida, caulibus 4–6 '' longis; foliis pinnatis, pinnis paucijugis crenatis rhombeo-rotundatis reniformi-rotundatisve terminali cordato. *Umbellæ* compositæ. *Involucrum* generale nullum, partiale foliolis paucis. *Calycis* margo integer. *Petala* inflexa. *Styli* breviusculi.

This may belong to the Abyssinian genus to which I have doubtfully referred it; but not being in fruit, nothing can be made of it.

4. Genus ?

*Hab.* In Clarence Peak, alt. 9500 ped. (fl. Dec.)

*Herba* glabra, elata, 2–3-pedalis; radice insapida; caule tereti striato; foliis radicalibus tripinnatis, foliolis ovato-lanceolatis, lobatis, pinnatifidisve, segmentis acutis. *Umbella* composita. *Involucrum* universale et partiale foliolis paucis linearibus. *Calycis* limbus 5-lobus, lobis acutis. *Petala* inflexa. *Styli* mediocres recurvi. *Mericarpia* immatura anguste oblonga, late alata, dorso 5-juga.

This is a very ordinary form of *Umbellifera*, presenting no striking character.

### ARALIACEÆ.

**PARATROPIA MANNII**, *H.f.* Glaberrima, foliis 4–9 foliolatis, petiolis petiolulisque gracilibus, foliolis ovato- v. oblongo-lanceolatis longe acuminatis integerrimis superne lucidis venis inconspicuis, marginibus subundulatis, floribus in capitulos arcte connatis, capitulis secus ramos simplices elongatos racemosis longe pedunculatis.

*Hab.* In Ins. Fernando Po, alt. 5000 ped, (fl. Dec.)

*Arbor* 40-pedalis, caule crasso. *Folia* stipulata, stipulis 1'' dorso supra medium petiolo adnatis ovato-lanceolatis subspathaceis; petiolo 6–8'', tereti; petiolulis 1½'' apice subarticulatis; foliolis 4–7'' coriaceis, inferne opacis. *Inflorescentia* ut videtur terminalis, ramis floriferis in ramulo apice crasso confertis, 1' et ultra, strictis, erectis, v. erecto-patentibus, basi bracteatis; bracteis stipulis similibus. *Capitula* diam. pisi, globosi, sub-20-flori, secus pedunculos floriferos racemosi, pedunculis crassis 1'' long. post anthesim sæpe decurvis. *Flores* sub $\frac{1}{6}$'' expans., flavi, hermaphroditi ? bracteolis late ovatis pubescentibus ovario brevioribus suffulti. *Ovarium* late obconicum, 5-loculare, obscure angulatum. *Calycis* limbus truncatus, integer, brevis, liber. *Petala* ovata apice inflexa. *Filamenta* subulata petala æquantia; antheris breviter oblongis flavis. *Stigmata* punctiformia, disco late conico vix elevato.

A very handsome plant, of which Mr. Mann has collected excellent specimens.

## RUBIACEÆ.

1. Galium Aparine, *L.* *Var.* hamatum.

G. hamatum, *Hochst.*; *A. Rich. Flor. Abyss.* i. 345.

*Hab.* In Clarence Peak, alt. 6–8000 ped. (fl. Dec.) Flores flavi.

I find it impossible to distinguish this from *G. Aparine*, L. A. Richard remarks of the Abyssinian specimens of *hamatum*, that the hooks of the leaves are stronger and more marked than in any other of the genus; but I do not find them to be so in his or this plant, though more strong than in many European specimens of *G. Aparine*. Mr. Mann describes the flowers as yellow, A. Richard as *apparently* purple. It is also a native of South Africa and many other parts of the world.

2. Galium rotundifolium, *L.* *Var.* foliis acutioribus.

*Hab.* In cacumine Clarence Peak, alt. 10,000 ped. (fl. Dec.)

All the leaves of the Fernando Po specimens are acute, or rather mucronate; some of those of the Abyssinian specimens are so too, whereas in the European and Indian forms they are more or less obtuse: still all the other characters appearing identical with those of the European, I cannot separate this on the grounds of one which is variable. Mann describes the flowers as yellow; in the dried specimens they appear white.

3. ANTHOSPERMUM ASPERULOIDES, *H.f.* Parvulum, caule flexuoso teretiusculo hirtello, foliis parvis fasciculatis lanceolatis subsessilibus, stipulis utrinque rigide subulatis marginibus recurvis parce hispidulis, floribus parvis tetrameris, coccis oblongis lævibus glaberrimis.

*Hab.* In cacumine Clarence Peak, alt. 10,000 ped. (fl. Dec.)

*Herba* parvula, 8″ alt., parce ramosa, foliosa. *Caules* teretiusculi. *Folia* densa, patula, ¼″ long.

Allied both to Cape and Abyssinian species, but distinct from any known to me by the small size, flexuose habit, and erect subulate limb to the sheathing stipules.

## COMPOSITÆ.

1. VERNONIA CLARENCEANA, *H.f.* Erecta, herbacea, gracilis, subhispido-pilosa; caule parce diviso subflexuoso, foliis linearibus lineari-lanceolatisve sessilibus semi-amplexicaulibus remote serrato-dentatis acuminatis, capitulis multifloris ad apicem caulis congestis breve pedunculatis, pedunculis tomentosis, involucri late campanulati squamis rigidiusculis lineari-lanceolatis acuminatis purpureis, dorso pilosis subherbaceis.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Herba* rigidiuscula, 1–2-pedalis. *Caulis* purpureus, laxe foliatus, superne subvillosus. *Folia* 2–3″ long., suberecta, paulo recurva, ⅓″–¾″ lat., inferiora in petiolum subangustata, superiora basi latiora, rigide membranacea, utrinque subhispido-pilosula, nervis paucis prominulis. *Capitula* 10–15 ad apices ramulorum, ⅓″ long. et lat. non bracteata.

*Involucri* squamæ sub 2-seriales, enerves, margine scariosæ. *Receptaculum* planum, foveolatum, nudum. *Flores* numerosissimi, perplurimi fœminei; tubus corollæ gracilis, pappo et stylo gracili dimidio brevior. *Pappus* albus, nitidus, 1-serialis, pilis filiformibus flexuosis scaberulis. *Achænium* parvum, pallidum, glaberrimum, valde compressum, oblique obovoideum, margine subincrassato. Fl. masc. pauci, 5-dentati.

This belongs to the section with *V. attenuata*, DC., and is most nearly allied to an Abyssinian one called *V. inulæfolia*, Steud.

2. Adenostemma viscosum, *Forst.*

*Hab.* In Fernando Po, alt. 4–8000 ped. (fl. Dec.)

*Herba* 3–4-pedalis, corollis albis.

I believe that there is but one species of this genus in the Old World; it is a native of Abyssinia (*A. Schimperi*, C. H. Schultz), of South Africa, of all Tropical Asia and the Pacific Islands. The Fernando Po form is the common Indian one.

3. Dichrocephala oblonga, *H.f.* Hispidulo-pilosa, caule tereti apice ramoso, foliis sessilibus patulis lineari- v. oblongo-lanceolatis acuminatis irregulariter pinnatifido-lobatis marginibus recurvis lobis subremotis incisis lobulis acutis v. mucronatis, capitulis late oblongis purpureis, involucri squamis 6–8 herbaceis pubescentibus, receptaculo columnari.

*Hab.* In cacumine Clarence Peak, alt. 10,700 ped. (fl. Dec.)

*Herba* erecta, rigidula, 1–2-pedalis. *Folia* 1½"–2" long.; ⅛"–½" lat. *Capitula* ¼" long.—*D. chrysanthemifoliæ*, DC. (Abyssinica, C. H. Schultz) proxima, differt habitu rigido, caule simplici, foliis angustioribus rigidis acutius lobatis, et præcipue capitulis oblongis, involucro oligophyllo et receptaculo columnari.

The nearest ally of this is *D. chrysanthemifolia*, a native of Abyssinia and India.

4. Helichrysum (Xerochlæna) Mannii, *H.f.* Caule robusto villoso apice ramoso; foliis densissimis sessilibus, patulis demum reflexis, semiamplexicaulibus oblongo-lanceolatis acutis integerrimis enerviis subtus marginibusque tomento appresso niveis, pedunculis basi capitulisque magnis albis v. pallide stramineis foliaceo-bracteatis, involucri squamis numerosissimis hyalinis splendentibus acuminatis.

*Hab.* In cacumine Clarence Peak, alt. 10,000 ped. (fl. Dec.)

*Herba* robusta, dense foliosa, pedalis et ultra, tomentosa. *Caulis* strictus erectus, teres, simplex, densissime foliatus. *Folia* 2"–3" long., ⅔"-lata, acuta et apiculata, inferiora supra glabrata, inferne dense appresse lanata, superiora utrinque laxius lanata v. araneosa. *Capitula* subpaniculatim corymbosa, bracteis foliaceis fere tecta, expansa 1¼' lata, pedunculis araneosis bracteolatis. *Involucri* squamæ perplurimæ, multiseriatæ, suberectæ, flosculis ⅕" excedentes, apicibus acuminatis vix recurvis, externæ araneosæ, ceteræ glaberrimæ, internæ minores et

angustiores late unguiculatæ, supra unguem purpureæ. *Receptaculum* convexiusculum, amplum, alveolatum. *Flosculi* numerosissimi. *Pappus* paucisetosus. *Corolla* anguste tubulosa. *Achænium* minimum glabriusculum.

A noble species, allied to *H. fœtidum*, but differing in the dense foliage, leaves less broad at the base, different form of inflorescence, which is more paniculate than corymbose, and much larger capitula.

5. Helichrysum (Xerochlæna) fœtidum, *Cass.*; *A. Rich. Flor. Abyss.* i. 426.

*Hab.* Ad Clarence Peak, alt. 10,000 ped. (fl. April.)

An extremely variable plant, native of Abyssinia, South Africa, Madagascar, and Mauritius, varying in breadth and tomentum of foliage, somewhat in size of the capitula, and much in their colour, from white to deep golden yellow.

6. Helichrysum (Chionostemma?) chrysocoma, *C. S. Schultz*; *A. Rich. Flor. Abyss.* i. 424. Var. *angustifolium*, gracile, foliis anguste lanceolatis acuminatis marginibus revolutis tomentosis v. superne glabratis; pappi setis albis.

*Hab.* Clarence Peak, alt. 10,000 ped. (fl. April.) *Herba* 4-pedalis.

I have examined several authentically named Abyssinian specimens of this plant, which present great variations in tomentum and breadth of foliage. The present differs from all in being rather more glabrous and slender, and smaller in foliage. The inflorescence, capitula, involucres, and florets are identical in all. The receptacle in all is covered with conical subulate elongate dark-yellow rigid bodies, that are persistent after the florets have fallen away. They are not noticed in A. Richard's work; these would refer this species to DeCandolle's section *Chionostemma*, were it not that the setæ of the pappus are quite free at the base. Richard describes the pappus as ferruginous, but it is white in all the Abyssinian specimens I have examined of Schimper's, and in the Fernando Po ones also.

7. Helichrysum (Achyrocline) Hochstetteri, *C. H. Schultz*; *A. Rich. Flor. Abyss.* i. 429.

*Hab.* Clarence Peak, alt. 8500 ped. (fl. Jan.) *Herba* 2-3-pedalis.

Mr. Mann's specimens are not a full flower, but the small size, great number and form of the capitula, the involucral scales, habit, tomentum, foliage and winged stems, leave no room to doubt that the present is identical with the Abyssinian plant, of which I have compared many specimens. The bruised capitula of the Abyssinian plant are aromatic, a character I do not observe in the Fernando Po, which are probably either too young, or, owing to the damp climate, deficient in aroma.

8. Helichrysum (Chionostemma?) globosum, *C. H. Schultz*; *A. Rich. Flor. Abyss.* i. 425.

*Hab.* Clarence Peak, alt. 10,000 ped.

Apparently identical with the Abyssinian plant.

9. Gynura vitellina, *Benth. in Niger Flora*, 438.

*Hab.* Fernando Po, ad 8500 ped. in Clarence Peak attingens. (fl. Dec.)

First found in Fernando Po by Vogel, afterwards by Barter on the same island, and in Abyssinia by Dr. Roth. It is an instance of a mountain plant descending to the level of the sea at the base of the mountains, but not found elsewhere at the same level, on the African coast.

10. SENECIO (OBÆJACÆ) CLARENCEANA, *H.f.* Herbacea, erecta, glaberrima, caule folioso, foliis amplis patulis sessilibus lineari-oblongis, v. oblongo-lanceolatis obtusis basi auriculatis marginibus semipinnatifidis, lobis grosse dentatis, capitulis (½″ long.) corymbosis obconico-campanulatis gracile pedicellatis multifloris, involucri vix calyculati foliolis linearibus pedicellisque puberulis, flosculis omnibus tubulosis (sub 30–40), achæniis glabris.

*Hab.* Clarence Peak, alt. 9000 ped. (fl. Dec.)

*Herba* 2-pedalis, robusta, glabra nisi pedunculis pedicellis involucrisque puberulis. *Caulis* erectus, simplex. *Folia* 3″–5″ long., 1″ lat., subcarnosula, subtus pallidiora. *Corymbi* multiflori.

11. SENECIO (ARBORESCENTES) MANNII, *H.f.* Glaberrima, ramis apice foliatis teretibus cicatricatis, foliis breve petiolatis lanceolatis longe acuminatis dentatis costa nervisque subtus creberrimis pilosulis, paniculis terminalibus ramosis multifloris, ramis pedunculis pedicellisque gracilibus pubescentibus capitulis (⅓″ long.) angustis paucifloris, involucri squamis paucis erectis apice incurvis anguste linearibus basi bracteolatis.

*Hab.* Fernando Po, alt. 6000 ped. (fl. April.)

*Arbor* parva, 25′ alt., ramis crassiusculis. *Folia* spithamæa et ultra 1½″ lat., petiolo vix 1″ long., membranacea, utrinque concolora, juniora parce ferrugineo-tomentella, nervis crebris subhorizontalibus. *Panicula* longiuscule pedunculata, 6″ alt., ramis subelongatis. *Involucri* squamæ (sub 5) angustæ, medio herbaceæ, acute carinatæ, marginibus late hyalinis, apicibus incrassatis. *Flosculi* sub 6, achæniis glabris.

A handsome species, resembling some of the Indian mountain forms.

## LOBELIACEÆ & CAMPANULACEÆ.

1. LOBELIA (TUPA) COLUMNARIS, *H.f.* Tota pubescenti-tomentosa foliis confertis sessilibus anguste lanceolato-oblongis acutis irregulariter denticulatis subtus dense tomentosis, racemo elongato conico densifloro, floribus dense pubescentibus.

*Hab.* Clarence Peak. (fl. Dec.)

*Herba* robusta, ut videtur 3–4-pedalis, dense foliosa. *Caulis* crassus, simplex, diam. digiti majoris. *Folia* 4″–6″ long., ¾″–1″ lat., erecto-patentia, nervis crebre reticulata. *Racemus* 8″–12″ long. *Flores* densissime imbricati, 1⅓″ long., angusti; alabastris cylindraceis, lente curvis. *Bracteæ* inferiores foliaceæ, flores subæquantes, superiores breviores. *Pedicelli* inferiores 1″ long. *Calycis* tubus hemisphæricus, lobis anguste lanceolato-subulatis, integerrimis, corollam triente brevioribus. *Corolla* lobis anguste ligulatis tubum æquantibus. *Staminum* tubus fere rectus, pubescens; antheris pilosis vix barbatis.

Closely allied to *Lobelia nicotianæfolia* of India. There are two Abyssinian allies, but no described South African, Mauritian or Madagascar.

2. Wahlenbergia polyclada, *H. f.* Hispido-pilosa, superne glabra, caulibus e collo numerosissimis basi decumbentibus demum erectis apice dichotome ramosis floriferis, foliis (parvis) sessilibus oblongo- v. ovato-lanceolatis acutis integerrimis undulatis, floribus parvis, calyce longe obconico, corolla brevissima capsula biloculari.

*Hab.* Clarence Peak, ad declivum orientem alt. 9000 ped. (fl. Dec.)

*Herba* radice gracili. *Caules* spithamæi ad pedalem, inferne et folia pilis hispidulis subcrispatis laxiuscule vestiti, superne divisi, glaberrimi gracillimi. *Folia* ¼″–⅓″ long., basi obtusa v. subcordata, margine lente recurva. *Flores* ⅓″ long.; calycis tubus anguste obconicus, lobis breviusculis, triangulari-lanceolatis. *Corolla* parva, cærulea, *calycis* lobos vix superans, an perfecta?

Not unlike *W. gracilis*, a very widely diffused Australian, Indian, &c. species, and of the same habit.

3. Wahlenbergia arguta, *H. f.* Glabra, caulibus gracillimis elongatis ascendentibus, apice pedunculos elongatos dichotome ramosos gerentibus, foliis sessilibus lanceolatis acuminatis argute serratis, floribus mediocribus, calyce brevissime obconico, corolla campanulata, capsula semisupera 3-loculari.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Herba* gracillima, caulibus flexuosis pedalibus parce vage ramosis. *Folia* ½″–¾″ long., basi angustata, marginibus tenuiter recurvis. *Pedunculi* 3–4-pollicares, superne dichotome divisi, ad axillas bracteati, bracteis subulatis. *Flores* ⅓″–½″ longi, suberecti. *Calycis* tubus brevissimus, lobis triangulari-lanceolatis, corolla pallide cærulea multoties brevioribus. *Capsula* trapezoidea semisupera.

The habit of this species is that of the St. Helena *W. angustifolia*, ADC, to which it is nearly allied, though the capsula is 3-celled.

## Ericeæ.

1. Leucothoe angustifolia, var. β. pyrifolia, *DC. Prodr.* i. 603.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Arbor* 15–20-pedalis, corolla rufo-ferruginea.

Apparently identical with the plant of Mauritius and Bourbon; it also inhabits Madagascar. The flower and fruit vary a good deal in size.

2. Blæria spicata, *Hochst.*; *A. Rich. Flor. Abyss.* ii. 13.

*Hab.* In cacumine Clarence Peak, alt. 10,700 ped. (fl. Dec.)

*Fruticulus* pedalis.

This is identical with the Abyssinian plant. The genus was previously supposed to be confined to South Africa and Abyssinia.

3. **Ericinella Mannii**, *H.f.* Ramulis puberulis, foliis appressis glabris nitidis, pedicellis folia superantibus, sepalis superioribus corolla dimidio brevioribus, antheris muticis inclusis, stylo breviter exserto.

*Hab.* Clarence Peak, alt. 10,000 ped. (fl. Dec.)

*Frutex* 10-pedalis.

Extremely closely allied to the South African *E. multiflora*, Kl., and Madagascar *E. gracilis*, Benth., and almost intermediate between these, though quite distinct from both. It differs from *gracilis* in the pubescence, white stems and branches, longer pedicels and shorter sepals; from *E. multiflora* in the longer pedicels, erect leaves, muticous anthers and short style.

### LOGANIACEÆ.

1. **Anthocleista scandens**, *H.f.* Caule tetragono, foliis petiolatis obovatis apiculatis, petiolis non alatis basi exauriculatis, corolla 12-mera, antheris fauce corollæ sessilibus.

*Hab.* Clarence Peak, alt. 5000 ped. (fl. Dec.)

*Arbor* scandens, 50-pedalis. *Ramuli* non spinosi. *Folia* 3″–4″ long., petiolo pollicari. *Calyx* fere 1″ long. *Corolla* 2″ expans. *Bacca* obovoidea, 2-pollicaris.

A very distinct species from *A. Vogelii* or *nobilis*, with flowers twice as large, leaves not half as large, sessile anthers, and a much larger berry.

### GENTIANEÆ.

1. Sebæa brachyphylla, *Griseb.*; *DC. Prodr.* ix. 53.

*Hab.* Clarence Peak, 8500—10,000 ped. (fl. Dec.)

*Herba* 1–1½-pedalis, floribus flavis.

Appears identical with the Madagascar plant.

2. **Swertia Clarenceana**, *H.f.* Glaberrima, caule erecto anguste alato, foliis cordato-subrotundis obtusis margine recurvis, sepalis oblongis obtusis corolla dimidio brevioribus, corollæ lobis obovato-oblongis obtusis, staminibus 5, foveæ nectariferæ marginibus fimbriatis.

*Hab.* Ad cacumen ipsum Clarence Peak, alt. 10,700 ped. Exempl. solitarium. (fl. Dec.)

*Herba* 6″ alt. subrobusta, caulis alæ angustæ, interdum margine subglanduloso-denticulata. *Folia* ⅓″ long. *Flores* laxe cymosi, pro planta majusculi, fere ¾″ expans.

Very nearly allied to *S. Abyssinica*, but differs in more stout habit and much larger flowers.

### MYRSINEÆ.

1. Mæsa Indica, *ADC.*; *Prodr.* viii. 80.

*Hab.* Fernando Po, alt. 5000 ped. (fl. Nov.)

*Arbor* parva, 15–20-pedalis.

This does not differ from the Indian plant, which is found from the Himalaya to Australia. It is also very similar to a Natal and East African species, with ciliated panicles.. The *M. lanceolata* of Abyssinia differs more in texture and size than any floral characters.

### LABIATÆ.

1. PLECTRANTHUS (COLEOIDES) GLANDULOSUS, *H.f.* Herbaceus superne glanduloso-pilosus, foliis petiolatis ovato-cordatis acutis grosse crenatis crenis crenulatis membranaceis, racemis laxe paniculatis, paniculæ ramis patentibus paucifloris, pedicellis gracilibus, corollæ defractæ labio inferiore porrecto saccato.

*Hab.* In Clarence Peak, alt. 7000 ped. (fl. April.)

*Herba* diffuse ramosa, 8-pedalis. *Rami* graciles, obtuse tetragoni, superne cum petiolis et inflorescentia glandulosi. *Folia* patentia longe petiolata, 3″-5″ long., 2″–4″ lat., supra glabra, subtus ad nervos pilosula, petiolis 2″–3″ long. *Panicula* ampla, laxa, divaricatim ramosa. *Verticillastra* pauciflora, floribus gracile pedicellatis in pedunculo communi gracili ternis. *Calyx* breviusculus, labio superiore brevi 1-lobo recurvo, inferiore longiore 4-fido lobis subulatis. *Corolla* cærulea, fere ⅔″ long., labio superiore reflexo, inferiore cymbiformi obtuso.

This has near allies both in South Africa, Abyssinia, Madagascar, and India: it differs from the technical character of the *Coleoideæ* in the pedicelled flowers.

2. PLECTRANTHUS (INDI) RAMOSISSIMUS, *H.f.* Pubescente-pilosa v. tomentosa, caule herbaceo erecto, ramis divaricatis, foliis petiolatis ovato-lanceolatis acutis crenatis utrinque pubescenti-pilosis, floralibus similibus sessilibus, cymis evolutis secus ramulos floriferos seriatim dispositis, pedunculis gracilibus apice ramosis 10–12-floris, calycibus villosis canis parvis, corollæ tubo pubescente recto.

*Hab.* In Fernando Po, alt. 5000 ped. (fl. Dec.)

*Herba* 6-pedalis, gracilis, divaricatim ramosissima, caulibus ramisque pilis subferrugineis sæpe deflexis vestitis. *Folia* 1½″–2″ longa. *Rami* floriferi 6″–10″ long. *Cymæ* pedunculi patentes, graciles, ½″–¾″ long., apice bracteas 2 patentes subulatas gerentes. *Flores* parvi, ¼″ long. *Calycis* tubus canus, basi hemisphæricus, ore obliquo contracto. *Corolla* calyce ter longior, alba, recta v. lente curva, lobis subæqualibus recurvis, genitalibus longe exsertis.

All the other African plants of this section (Cape, Madagascar and Abyssinia) belong to a group in which the cymes are crowded and nearly sessile, with the corolla tube defracted. The present is much more closely allied to several mountain Indian species.

3. Pycnostachys Abyssinica, *Fresen. Flora,* 1838, ii. 608.

*Hab.* Fernando Po, alt. 700 ped. (fl. Dec.)

*Herba* 8-pedalis, corolla violacea.

Judging from the short description of Fresenius in the 'Flora,' this is

certainly his plant. It differs from its very near ally *P. cærulea* of Abyssinia in the large flowers and calyx and dense pubescence; from the Cape *P. reticulata* in the petiolate and broader leaves.

4. Calamintha Simensis, *Benth. in DC. Prodr.* xii. 230.
*Hab.* Clarence Peak. alt. 8500 ped. (fl. Dec.)
*Herba* 2-pedalis, corolla purpurea.

This in no way differs from Abyssinian specimens, and is very nearly allied to the European *C. Acinus*, Benth.

5. STACHYS (STACHYOTYPUS) ACULEOLATA, *H.f.* Caule tenui procumbente elongato petiolisque retrorsum aculeolatis, foliis petiolatis ovato-cordatis obtusis grosse crenatis, verticillastris sessilibus sub 3-floris, floribus breve pedicellatis, calyce obconico subæqualiter 5-dentato lobis spinulosis, corolla tubo exserto, labio inferiore porrecto amplo trilobo lobo medio bilobo.
*Hab.* Clarence Peak, alt. 9000 ped. (fl. Dec.)
*Herba* parce ramosa, 1′–2′ longa. *Folia* distantia, 1″–1½″ longa, fere æquilata, petiolo pollicari. *Verticillastra* pauca, distantia, axillaria. *Flores* ½″ long., pallido purpurei tubo longe supra basin intus barbato, extus piloso. *Antheræ* divaricatæ.

This is the same with an undescribed Abyssinian species collected by Dr. Roth; but the stem is more slender, the petioles longer, the calyx rather smaller; I have no corolla in the Abyssinian specimen.

## SOLANEÆ.

1. Solanum Indicum, *L.* Var. *micranthum.*
*Hab.* Fernando Po, alt. 6000 ped.
*Frutex* 6–8-pedalis, floribus albis.

Common throughout Tropical Africa, and probably not different from *S. Adoense* of Abyssinia.

## ACANTHACEÆ.

1. Dicliptera maculata, *Nees.*? *A. Rich. Fl. Abyss.* ii. 158.
*Var.* Glanduloso-pilosa, floribus majoribus.
*Hab.* Fernando Po, alt. 5000 ped. (fl. Dec.)
Scandens 20-pedalis, corolla alba.

Apparently quite the same as the Abyssinian plant, but the flowers are either larger or owe their appearance of being so to better drying. In the Fernando specimens all parts are pilose and glandulose, in Abyssinian ones glabrous, but in A. Richard's character they are stated to be covered with cottony hairs. In the Fernando Po and one Abyssinian specimen the involucral leaves are quite obtuse and muticous, in another Abyssinian they are obscurely mucronate, and in a third ovate and pungent. Perhaps more than one species is included under this name.

### SCROPHULARINEÆ.

1. Limosella aquatica, *L.* Var. *tenuifolia.*

*Hab.* Clarence Peak, alt. 9000–10,000 ped. locis humidis. (fl. Dec.,

This is an American, Australian, and South African form; the Abyssinian is the common European one, which also grows in South Africa.

2. Veronica (Veronicastrum) Mannii, *H.f.* Caule e basi decumbente erecto simpliciusculo bifariam pubescente foliato, foliis sessilibus oblongo-lanceolatis remotiuscule serrulatis acutis, racemo terminali conferto glanduloso-tomentoso, staminibus corolla brevioribus, capsula orbiculata emarginata.

*Hab.* Ad cacumen Clarence Peak, alt. 10,700 ped. (fl. Dec.)

*Herba* gracilis, pedalis. *Caule* tereti basi radicante. *Folia* ⅔″ long., subcoriacea. *Racemus* brevis v. elongatus. *Flores* breve pedicellati, cærulei ⅓″ expans. *Calycis* lobi oblongi, obtusi, capsulam æquantes.

Very nearly allied to *V. glandulosa,* Hochst., of Abyssinia, but, as far as the several excellent specimens of both show, quite distinct in the narrow leaves and sepals, and bracts shorter than the flowers. It may well, however, prove to be a variety of that plant.

### PLANTAGINEÆ.

1. Plantago (Leptostachys) palmata, *H.f.* Rhizomate perenni horizontali, foliis longe petiolatis late cordato-orbiculatis palmatim 5–7 lobis, spica gracili, capsulis dispermis.

*Hab.* Clarence Peak, alt. 8000 ped. (fl. Dec.)

Glabra v. parce pilosa. *Rhizoma* crassum, fibras rigidas demittens, collo brevi. *Petioli* 4″–6″ longi, glabriusculi, apice dilatati. *Folia* 2″–3″ long. et lat., membranacea, nervis radiantibus. Scapi petiolis subbreviores. *Flores* inter minores, laxe imbricati, basi laxe barbati. *Bracteolæ* et sepala consimilia obtusæ oblongæ dorso medio herbaceæ late scarioso-marginatæ, glabræ v. parce pilosæ. *Corolla* parva, genitalibus longe exsertis. *Capsula* calycem paulo superans. *Semina* viridia, crassiuscula, cymbiformia.

A very remarkable species in the form of the leaf.

### SANTALACEÆ.

1. Thesium (Euthesium) tenuissimum, *H.f.* Ramis e collo perplurimis ramulosis ramulisque gracillimis glaberrimis sulcatis, racemo ramoso, bracteolis 2 bracteam superantibus perianthio dimidio brevioribus ovato-subulatis, perianthii subcampanulati 4-5-fidi lobis inflexis exauriculatis, stylo stamina attingente, stigmate capitellato.

*Hab.* Ad Clarence Peak, alt. 9000 ped. (fl. Dec.)

*Radix* elongatus, teres, crass. pennæ corvinæ. *Rami* 4″–6″, gracillimi, angulati, squamulis minutis raris subulatis aucti. *Racemi* rami pauci breviusculi fasciculis sub 3-floris. *Bracteæ* et *bracteolæ* carinatæ obscure ciliatæ. *Perianthium* $\frac{1}{8}''$ long. obscure et obtuse angulatum, lobis breviusculis glaberrimis v. margine obscure ciliatis. *Filamenta* ori inserta, antheris duplo longiora.

Very nearly allied indeed to *T. Madagascarense,* A. DC., which is the only other species of this vast genus in which the bracteolæ exceed the bracts, and the stems are almost leafless. It differs remarkably from that plant in size, in the very numerous very slender stems and branches, and much smaller flowers.

### THYMELEÆ.

1. PEDDIEA PARVIFLORA, *H.f.* Stamina ori perianthii inserta, ovarium apice villosum.

*Hab.* Fernando Po, alt. 5000 ped. (fl. Nov.)

*Arbor* 15–20-pedalis, floribus viridibus.—*P. Africanæ,* Harv., simillima, differt ramis gracilibus foliis magis membranaceis, floribus duplo minoribus, staminibus ori perianthii insertis, ovarioque apice toto villoso.

The only congener of this is a subtropical Port Natal tree.

### URTICEÆ.

1. Parietaria Mauritanica, *Wedd.*

*Hab.* Clarence Peak, alt. 8000 ped. (fl. Dec.)

*Herba* 6–8 pedalis.

The bracts are decidedly ovate, though narrower than usual in this form which seems to pass into *P. debilis,* Forst.; it is described by Weddell as a Mediterranean and North African species.

### EUPHORBIACEÆ.

1. EUPHORBIA (ESULA) AMPLA, *H.f.* Herbacea, glaberrima, foliosa; caule simplici superne patentim ramoso, foliis membranaceis petiolatis lanceolatis acutis subtus glaucescentibus, floralibus late ovato-cordatis v. triangulari-ovatis acuminatis, involucris solitariis laminis fimbriatis, glandulis semilinearibus cornubus brevibus.

*Hab.* In Clarence Peak, alt. 8500 ped. (fl. Dec.)

*Herba* 4-pedalis, caule crassiusculo, terete, inferne nudo. *Rami* patentes, conferti, spithamei et ultra, foliosi, terminalibus divaricatis. *Folia* 4″–5″ long., $\frac{3}{4}''$–1″ lat., integerrima, tenuiter nervosa, nervis divaricatis. *Involucra* sparsa, minima, solitaria. *Stamina* sub 8.

The habit of this species resembles *E. Lathyris,* but the whole plant is of a totally different texture; it is most near *E. monticola,* Hochst., of Abyssinia, but has not the involucral glands produced into subulate horns as in that plant. It is also allied to the Indian *E. Rothiana*; but in that the inflorescence is borne on peduncled special branches, and the involucres are numerous.

2. CLAOXYLON (ATHROANDRA) MANNII, *H.f.* Glaberrimum, gemmis

perulatis, foliis alternis petiolatis lanceolatis acuminatis irregulariter sinuoso-serratis basi biglandulosis, fl. masc. laxe paniculatis, gracile pedicellatis, perianthio late campanulato 4–5 fido lobis triangularibus valvatis, antheris numerosissimis in globum supra receptaculum aggregatis, fl. fœm. perianthio 2-lobo, glandulis 2-lobis alternantibus, ovario 2-loculari, stigmatibus elongatis.

*Hab.* Fernando Po, alt. 5000 ped. (fl. Dec.)

*Frutex* 15-pedalis, ramis fragilibus teretibus. *Gemmæ* in axillis foliorum brevibus squamulis late obovatis rigide coriaceis pallidis nitidis tectæ. *Folia* spithamæa, membranacea, basi 3-nervia, petiolo pollicari. *Racemi* axillares et cum ramulis e gemmis orti, petiolis breviores v. æquilongi, pedunculo gracillimo, floribus paucis subcorymbosis gracile pedicellatis, pedicellis ¼″–⅓″ long. *Alabastra* late ovoidea. *Flores* virides, ¼″ diam. *Antheræ* numerosissimæ, sessiles, squamulis non immixtæ, loculis globosis. *Fl. fœm.* parvi, perianthii lobis parvis minutis oblongis. *Styli* recurvi, elongati.

A very singular plant, probably generically distinct from *Claoxylon*, from all other species of which the perulate buds abundantly distinguish it. A very similar species was found in the Niger by Barter.* The structure of the flower agrees with the character of *C. cordifolium*, Benth., but in that the anthers are sessile. The name of *Athroandra*, signifying crowded stamens, will serve to distinguish these species whether as genus or section.

## COMMELYNACEÆ.

1. Cyanotis Abyssinica, *A. Rich.*? *Flor. Abyss.* ii. 344.

*Hab.* Clarence Peak, alt. 9000 ped. (fl. Dec.)

A fine species, remarkable for its round tuberous roots, the size of a hazel nut. It may be the same with a Madagascar and South African species, but the extremely fugacious flowers are very difficult of analysis, and judging from dried specimens, I hardly think them the same.

## ORCHIDEÆ.

[*By Dr. Lindley.*]

1. Calanthe, sp. nov.? C. Natalensi, *Reich.*, proxima.

*Hab.* In Clarence Peak, alt. 6000 ped.

*Herba* 1½″ alt. Corolla alba et purpurea.

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* *Claoxylon* (*Athroandra*) *Barteri*, H. f. Glabrum, gemmis perulatis, foliis ovato-lanceolatis abrupte acuminatis crenatis junioribus pilosis basi eglandulosis, fl. masc. parvis in pedunculum brevem gracilem sessilibus v. pedicellatis, perianthio 4-lobo, lobis valvatis, antheris ut in *C. Mannii*. *Fl. fœm.* stigmatibus parvis.

*Hab.* Flum. Niger ad Gomba, Eppah et Lagos,—beat. *Barter*. *C. Mannii* arcte affinis, differt foliis latioribus, parvis, 1″–2″ long. obsolete acuminatis basi non biglandulosis, floribus multoties minoribus et stylis brevibus.

2. Habenaria, sp. nov. H. peristyloides, *A. R.* (Abyssiniæ) et *H. præaltæ Thouars* affinis.

*Hab.* Ad cacumen Clarence Peak.

3. Polystachya?

*Hab.* Clarence Peak, alt. 6000 ped.

Epiphytica, species singularis et distinctissima. *P. capensi,* Sond., et *Ottonianæ,* Reichb., habitu similis.

4. Bolbophyllum, sp. nov.

*Hab.* Clarence Peak, alt. 5000 ped.

Epiphytica, *B. flavido* (Sierra Leone) affine.

### JUNCEÆ.

1. Luzula campestris, *L.*

*Hab.* Ad cacumen Clarence Peak, alt. 10,700 ped. (fl. Dec.)

I have seen no other Tropical African specimens of this plant, nor is any species of the genus mentioned in Richard's 'Flora of Abyssinia.' There is, however, a very similar plant in South Africa.

### CYPERACEÆ.

1. Carex Boryana, Schkuhr. Forma spica depauperata. (*Boott.*)

*Hab.* Clarence Peak, 8500 ped. (fl. Dec.)

Dr. Boott, who has identified this and the following for me, observes that he has a similar form from Bourbon, of which isle and Abyssinia this is a native.

2. Carex Wahlenbergiana, *Boott.* Illust. Carex, t. 301.

*Hab.* Clarence Peak, alt. 8000 ped. (fl. Dec.)

Of these specimens Dr. Boott remarks, that it has pale spikes, and shorter narrower bracts and leaves than the fully developed plants; but that he has the same pale spikes and narrow (but longer) leaves in Bourbon specimens. It is also a native of Mauritius.

3. Kyllingia macrocephala, *A. Rich. Flor. Abyss.* ii. 491.

*Hab.* Clarence Peak, alt. 8500 ped. (fl. Dec.)

I am very doubtful if this is anything but a form of the ubiquitous *K. monocephala*: the scales are however larger and of a somewhat different shape. Stamens 2.

4. Isolepis trifida: cf. T. pusilla, *Hochst.*, et T. gracillima, *Hochst.*

*Hab.* Ad cacumen Clarence Peak, alt. 10,700 ped. (fl. Dec.)

A common Indian plant, extending westward to Abyssinia and Senegal, and eastward to China.

5. SCHŒNUS? ERRATICUS, *H.f.* Pusillus, glaberrimus, rigidulus, caule basi bulboso, foliis filiformi-setaceis rigidis curvis supra canaliculatis subtus convexis, culmis nudis curvis filiformibus sulcatis apice monocephalis, capitulo ovoideo compresso e spiculis 1–3 piceis compressis

composito, involucro 1-3-phyllo spiculis breviore, foliolis ovato-lanceolatis acuminatis dorso carinatis, spiculis 5 8 lineari-oblongis compressis vix distiche imbricatis.

*Hab.* Clarence Peak, alt. 9000 ped. (fl. Dec.)

*Herba* 3-6-uncialis, culmis basi subbulbosis folia longe superantibus. *Folia* 1-2 pollicaria sulcata, acuminata, vix $\frac{1}{4}'''$ diam. vaginis brevibus rufis non nitentibus. *Capitulum* $\frac{1}{2}''$ long. *Spiculæ* confertæ, lineari-oblongæ, squamæ sub 8-10, infimæ paucæ latiores vacuæ, cæteræ subæquilongæ, oblongo-lanceolatæ, acutæ, vix carinatæ, opacæ, glaberrimæ. *Stamina* 3, discus et setæ hypogynæ 0. *Ovarium* parvum oblongum trigonum, stylo gracili basi simplice, stigmatibus 3 filiformibus.

I am doubtful of the genus of this plant; the scarcely distichous scales of the spikelet differing from *Schœnus*, to which it is otherwise referable. The scales are, however, not always regular in *Schœnus nigricans*, and in *Chætospora*, which must surely be reduced to *Schœnus*, the scales are sometimes imbricated all round. A. Richard's *Hemichlæna bulbosa*, to which this is a good deal allied, has distichous scales, but this plant differs materially from *Hemichlæna* in wanting the disk. I do not see how it differs from *Cyperus*, with many species of which it further agrees in the margins of the scales decurrent on the rachis.

## GRAMINEÆ.

1. Deschampsia cæspitosa, *P.B.* *D. latifolia*, Hochst.; A. Rich. Flor. Abyss. ii. 413.

*Hab.* Clarence Peak, alt. 10,100 ped.

Also found in Abyssinia and most other temperate parts of the globe, but not hitherto in South Africa.

2. Trisetum lachnanthum, *Hochst.*; *A. Richard. Flor. Abyss.* ii. 416.

*Hab.* Clarence Peak, alt. 7900-9000 ped. (fl. Dec.)

A very distinct species, closely allied to *T. virens*, Nees, of the Indian mountains.

3. Festuca Schimperiana, *A. Rich. Flor. Abyss.* ii. 433.

*Hab.* Clarence Peak, alt. 8500 ped. (fl. Dec.)

The spikelets are rather larger than in the Abyssinian specimens, but the species is evidently the same.

4. Brachypodum sylvaticum, *R. & S.*

*Hab.* Clarence Peak, alt. 7000 ped.

A native of Abyssinia (*B. flexum*, Nees).

5. Gymnandropogon, sp.? (*Schimper, Plant. Abyss.* 1853, No. 1006.)

*Hab.* Clarence Peak, alt. 9000 ped. (fl. Dec.)

This, which approaches very closely *A. glabriusculus*, Hochst., of Abyssinia, further seems identical with another and perhaps undescribed species of that genus, collected by Schimper, and quoted above.

## Note on an unusual mode of Germination in the Mango—*Mangifera Indica.* By MAXWELL T. MASTERS, Esq., F.L.S.

[Read April 4th, 1861.]

IN the Museum of the Royal Gardens at Kew, are preserved two specimens of the Mango in an advanced stage of germination, which present some peculiarities that may be deemed worthy of bringing under the notice of the Society. For the opportunity of examining and describing these curious plants, I am under great obligations to Dr. Hooker, and to Mr. Jackson the curator of the Museum. From these gentlemen I learn that the seeds in question were sent home by the late Mr. Barter, when accompanying Dr. Baikie on his second Niger Expedition in 1857, and were reared by Mr. Crocker at Kew.

From the appearance that these young plants presented on cursory inspection, and perhaps from the knowledge that the seeds of the Mango are occasionally poly-embryonous, the specimens were described in these words, "one mango seed producing many plants." The closer examination which I have been enabled to make leads me to conclude that there are, in reality, two seeds, presenting such peculiar appearances, especially when placed, as they were, in close apposition one to the other, as readily to give rise to the opinion before expressed. This will be understood at once by the circumstance of there being only two cotyledons present, from between which a great number of shoots apparently emerge. In one of these two seeds (*fig.* 1.) one cotyledon is present, though partly decayed and truncated at its upper part, possibly by some accident during growth; the other seed-leaf is absent, but there is a scar distinctly visible, indicating its original position. The plumule presents itself as a long, thick, fleshy, curved body, presenting no trace externally of leaves or buds; in the axil of the cotyledon, between it and the plumule, arises a leaf-bearing shoot, presenting no unusual features. The radicle is thick and tapering, and gives off a few slender rootlets. The second seed (*fig.* 2) is likewise deprived of one of its cotyledons, but the scar remains to attest its former presence. From the appearance of the tissues in the immediate vicinity of the scar, the missing seed-leaf seems to have perished from some cause inducing gradual decay, rather than from any injury or traumatic cause, to use a surgical expression. The existing cotyledon is oblong, oblique at the base, the outer surface convex, wrinkled on the upper half, while the lower half is scooped out and smooth like the inside of a shell. From this portion proceed

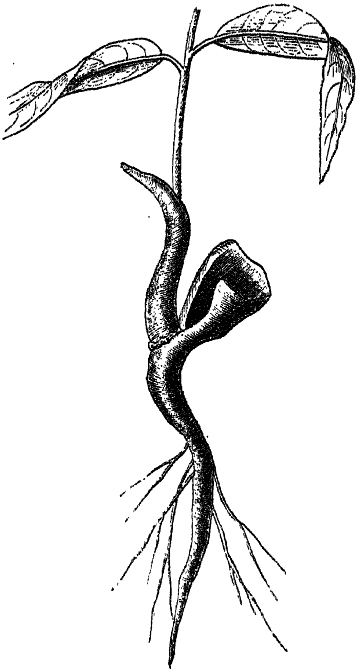

Fig. 1.

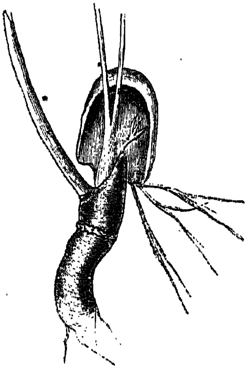

Fig. 3.

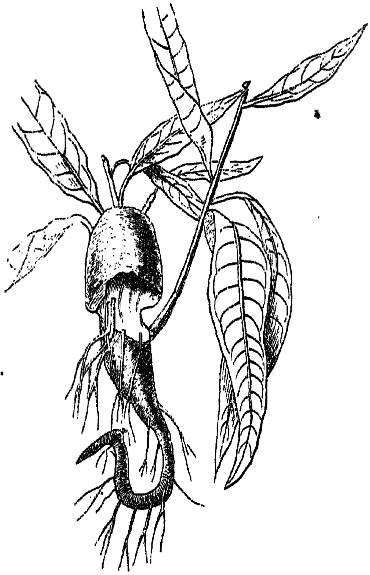

Fig. 2.

Fig. 2 outer
Fig. 3 inner } aspect of same seed. See reference on other side.

a number of adventitious roots. The inner surface (fig. 3) is concave, and offers no unusual appearance; the plumule in this instance is short, thick, fleshy, conical, and gives off, not from its summit, but from its side, some distance above the attachment of the cotyledons, three leafy shoots, one of which is small and but slightly developed, and another is divided into two branches a short distance above its origin. The radicle has a similar appearance to that of the first-mentioned seed.

To sum up the peculiarities presented by these specimens, there is, first, the entire absence of one of the cotyledons in both instances; next, the peculiarity of the plumule, in the one case giving off no shoot at all, in the other giving rise to three shoots from its side; and, lastly, there is the production of adventitious roots from the "scooped-out" portion of the cotyledon.

I do not know any instance of plumules presenting the peculiarities just mentioned, nor have I been able to find on record any case of adventitious roots springing from the cotyledons themselves, though there is no physiological or anatomical reason why, under certain circumstances, adventitious roots should not be developed in such a situation. Irmisch indeed describes similar rootlets arising from the petiole of the cotyledon in *Bunium creticum* and *Carum Bulbocastanum*[*].

The scooping out of the lower half of the outer surface of the cotyledon may not be an unusual occurrence in mango seeds, though it is certainly not invariable. Griffith describes the cotyledons of this plant as oblique at the base, with half of their outer surface wrinkled, half smooth, sometimes auricled, sometimes not, sometimes of different sizes. The plumule he describes as "stalked and well-marked." Gaertner figures seeds of this plant with apparently lobed cotyledons, the lobes being, as Reinwardt[†] shows, really separate seed-leaves belonging to distinct embryos; but the descriptions given by these writers by no means apply to the cases I have attempted to describe; nor does Alexander Braun, in his recently published memoir on 'Polyembryonous Plants,' among which mention is made of the Mango, describe anything like them.

[*] Flora, 1858, pp. 33-42.

[†] Reinwardt, Nov. Act. Acad. Car. Leop. Nat. Cur. 9-24, 4to, 12, 1, 37.

### REFERENCE TO THE WOODCUTS.

The figures are one half the size of the originals; Nos. 2 and 3 refer to the outer and inner aspect of the same seed respectively, but the details of the foliage, etc., are omitted in No. 3.

## Account of the Ascent of Clarence Peak, Fernando Po, altitude 10,700 feet. By Mr. GUSTAV MANN, Botanist to Dr. Baikie's Niger Expedition. In a Letter to Sir W. J. HOOKER, F.R.S., F.L.S., &c., and communicated by him.

[Read March 7, 1861.]

SIR,—As I informed you already in my letter before last, that I did not succeed at my first trial in ascending the mountain, I will give you now an account of my second trip, which was successful. On the 23rd of March I left Clarence for the second time, and commenced my ascent from here, keeping first eastwards and then turning south, and attaining the first day a height of 1300 feet. After I had passed two large Boobee towns, Barapa and Basile, finding the vegetation already quite different, I stopped to collect the few plants in blossom, and some nice Ferns, especially Trichomanes and Aspleniums. The trees were much overgrown by Orchids, Ferns, and Begonias, while moss hung a foot in length from the branches: there was in consequence much dry wood at the top of the trees. There were no Palms, nor herbaceous plants 15 feet high, as in the lower part. The temperature here in the mornings was 64°, at noon 70°, and in the evenings 66° Fahr. At about 1000 feet up I found the fine large Trichomanes growing on the ground, and the large Acrosticum?: these I sent in the Wardian case, and have dried specimens of both still here.

On the 27th of March I ascended to a height of 5000 feet: during this ascent I found the fine Cyathea. This species seems to form larger groups than other Cyatheas do, many averaging from 10–15 trunks, some of which rise to a height of 30 feet. The Onychium? of which I sent a specimen in the Wardian case, grows only as an epiphyte on this tree-fern. I also found on this ascent the fine Antrophyum?, resembling the Platycerium of the tropical part of the island; and the Liliaceæ, of which I sent six bulbs; and the Calanthe like Veratrifolia. All the Trichomanes grew between 1000 and 5000 feet. At this height I stopped one day, and ascended on the 28th to a height of 6000 feet, and on the 29th to 8500 feet; up to which height I found very little difference in the vegetation. From this place I was obliged to send a Krooman down to fetch more provisions, which, together with daily rain, obliged me to remain here six days. During this time I was compelled to sleep on the wet ground, placing my blanket and other things under an oil-cloth when the rain commenced at night, and selecting for myself a dry place where the rain did not come through the small roof of palm-leaves. This, under a temperature of 42° Fahr. at night, was a trial to my health; but one must learn everywhere, and I have learnt a great deal since I came here. The vegetation here consists mostly of herbaceous plants, as Gramineæ, Salvia, Rubus, &c. The largest trees here (50 feet high) are Araliaceæ and Compositæ. On the 3rd of April I reached the top, about two o'clock in the afternoon. Unfortunately a storm of rain and hail spoilt the enjoyment with which I should otherwise have seen the whole island spread out before me; but what was worse than this, I found the entire summit burnt, and no vegetation except grass, which was just beginning to sprout. This is done by the Boobees, to drive the deer to the lower part of the island. I did not meet with a Boobee above 1000 feet elevation. The top is formed by the highest side of the largest crater, which is about 40 feet deep. There is good and deep soil up to the top, and only on the inside of the largest crater are a few rocks visible. Lower down there are more small craters. At this time the temperature was 54° F., and the minimum at night 39° F.

Shrubs grow to between 400 and 500 feet of the top, and amongst them I found an Erica 8–10 feet high, which gave me much pleasure. I regret very much that I could not stop some days longer, but I ran the risk of making myself a cripple for life; I therefore commenced my descent on the 4th. Again it was too late in the season, for which reason very few plants were in blossom.

At the bottom of the highest part I found a small lake, perhaps only the result of the very heavy rain of the last few days. The large Hypericum forms the greatest part of the bush, and has a very pretty appearance from its fine light-green foliage. The first day I descended to 5000 feet, and on the 5th I went down to 1300 feet, where I remained six days, making excursions in different directions. The tree-fern and other living plants were collected the day before I set off on my return to Clarence, which place I reached on the 13th of April, and immediately commenced the arrangement of my plants, &c., being anxious to send away my collections by the last mail. After coming down from the mountain I needed a little rest, but having this work before me, I rather overworked myself, and took fever, which was the reason why I did not write to you by the last mail. I should be very glad to hear how the plants and specimens reached Kew, and if all was done to your satisfaction. It would also give me much pleasure if I heard that there was anything new among them. Yesterday I obtained a fruit spike of *Raphia vinifera*, 6 feet long, and so heavy that two men could scarcely carry it. Raphia is scarce on this part of the island, but is more abundant on the eastern side, because that part is lower, and this palm prefers a low swampy situation. It is much used, all the houses being roofed with its leaves. Next time I will send you some mats made from it, as they may be of interest for the Museum. At the north-west bay of the island an excellent sort of yam grows, quite like a good potato; on the eastern side they grow much larger, but are not nearly so good in quality. On the eastern side I also found good cotton, growing quite wild, and only gathered by the people when they have nothing else to do.

The whole island is uncultivated, with the exception of a small part near Clarence, for the yam-fields can scarcely be considered as cultivation. From February until now is the active time of year. In February the Boobees plant their yams, and in March the palm-oil season commences: the men bring home the nuts, and the women make and sell the oil. The island would yield ten times as much palm-oil, if the Boobees would make use of all that is growing; but these people have so few necessaries of life that they are not to be depended on.

To ascend the mountain one needs a good oiled tent with a hammock, and tin boxes to put everything in: an hour after I had dried my plants by the fire they were wet again, and I had therefore great difficulty in preserving them. It also requires at least six Kroomen to assist in the dry season. I have now quite recovered my health, and hope shortly to benefit by change of air when the ship goes up the river. I never thought that the difference of climate on the mountain and here would have had so much effect on me. On the mountain I enjoyed good health, except that I took a bad cold, from not having a sheltered place at night. By this mail I expected instructions from the Foreign Office, since till now I have received none at all, except that money has been granted to live on, and to go up the mountain, and for one Krooman to assist me. If the Expedition goes up the Niger again (which is doubtful), the collections will be entirely different.

I enclose a little sketch of the Consulate, thinking it may be of interest to you. Consul Hutchinson and his lady are going home to England; I shall thus lose a very kind friend, who has been like a brother to me. I heard from Mr. Hewen that you had inquired if it were possible to ascend the mountain of Bimbia or Cameron. You will hear shortly that it is quite impossible, and only killing men to send them up there; this, however, was also told me before I went up Clarence Peak. It is, no doubt, *very* difficult, but it is possible; only too much must not be expected from the first trip. Much might be gained by a second ascent; as would also, I think, be the case, if I could ascend the Peak here again, and remain there for some months during the dry season. To stop there in the wet season is quite impossible, and would be certain death.

GUSTAV MANN.

Clarence, Fernando Po,
May 31st, 1860.

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## On the Discovery of *Carex ericetorum*, Poll., as a Native of Britain. By CHARLES C. BABINGTON, M.A., F.R.S., F.L.S., Professor of Botany in the University of Cambridge.

[Read June 20, 1861.]

SEVERAL months since my friend Mr. John Ball, F.L.S., sent to me a specimen of *Carex*, gathered by him on the Gogmagog Hills in Cambridgeshire in the year 1838, and upon a careful examination of my Herbarium I found four specimens of the same plant, gathered at the same place on May 3, 1838, and probably in company with Mr. Ball. This plant was supposed by Dr. Boott to be the *C. ericetorum*, Poll. On referring to my notes I was enabled to ascertain the places visited on the above-mentioned day, and have lately revisited them more than once. At length, on May 28, 1861, I was so fortunate as to rediscover a single rather large patch of the same *Carex*, growing on the grassy slope of the Roman road, locally called the Wool Street, at about four miles and a half from Cambridge, and probably not far from the spot where it was gathered in 1838.

As I have now no doubt of its being the *C. ericetorum*, and a true native of the country, I venture to announce it as an addition to the British flora. This is no "split" from a recognized species, but a plant allowed by botanists to be a true species. At first sight it much resembles *C. præcox*, and inhabiting similar ground, may have been overlooked in many places. To the practised eye it has a decidedly different appearance when growing;

for the white edge of the scales of both kinds of its spikes gives it a silvery look very different from the dark hue of the *C. præcox*. The place where it grows is chalky and very dry, and there is an abundance of *C. præcox* in its neighbourhood. Although I have as yet only met with one patch of it, its restriction to that one spot is highly improbable; but unfortunately the chalk district of Cambridgeshire is so universally under the plough that few fit places for its growth now remain. It should be carefully looked for in similar places elsewhere in the south-east of England.

It may be known by the following characters:—Its fertile spikes are more ovoid and closer together than those of *C. præcox*; its glumes obovate, very blunt, with a pale margin, which is finely ciliated, especially at their tip; their midrib does not reach to the tip; its fruit is obovate. The nut I have not been able to examine, owing to the young state of the fruit. My specimens are about 3 or 4 inches high.

It is the *C. ericetorum* of Pollick (*Fl. Palatin.* ii. 480. A.D. 1777) and of other authors, the *C. ciliata* of Willdenow (in *Act. Berol.* for 1794. p. 47. t. 3. fig. 2) and others. The latter name would be much more characteristic of the plant, but the dates of publication conclusively determine that Pollick's name must be adopted.

## On some Species of Oaks from Northern China, collected by W. F. Daniell, Esq., M.D., F.L.S. By William Carruthers, Esq., F.L.S.

[Read June 20th, 1861.]

On returning from the late expedition to China, Dr. Daniell placed in my hands the specimens of several oaks which he had gathered on the shores of Taliewhan, a bay running into Southern Manchouria, to the west of the Corea, and chiefly in a small valley about a mile from the sea, where they grew mixed with *Pinus densiflora*, Sieb., *Salix Babylonica*, L., &c. The specimens belong to six species, three of which are new and undescribed. Two of these species, however, want flowers and fruit, and although remarkable in the shape and characters of their leaves, and different from anything hitherto noticed, I have not ventured to name and describe them from the foliage only. I have added a fourth species which I found among the plants, now in the Herbarium of the British Museum, brought home by Sir George Staunton from Northern China.

All of them, in which the fruit is known, belong to Blume's section of the genus characterized by the acorn cup having imbricated scales, and named by Endlicher *Lepidobalanus*. They are

1. Q. obovata, *Bge.*
2. Q. Mongolica, *Fisch.*
3. Q. McCormickii, n. sp.
4. Q. serrata, *Thunb.*
5. Q.—sp.?
6. Q.—sp.?
7. Q. acuminatissima, n. sp.

1. Quercus obovata, *Bge. Mem. St. Petersb.* vol. ii. p. 136.
*Hab.* From Taliewhan, *Dr. Daniell*; and between Pekin and Jehol, *Sir George Staunton.*

2. QUERCUS MONGOLICA, *Fisch*; *Ledebour Flora Rossica*, vol. iii. p. 589. Foliis petiolatis vel subsessilibus obovatis, basi auriculata sinuato-lobata, a medio ad basin cuneato-attenuatis sinuato-lobatis, lobis sursum versis subacutis muticis a medio utrinque decrescentibus, sinubus acutis, subtus glaucis glabris; cupula squamis adpressis gibbosis sericeis muricata, squamis superioribus parvis cupulam non excedentibus; nuce ovata cupulam duplo excedente styli basi apiculata.
*Hab.* From Taliewhan, *Dr. Daniell*; and between Pekin and Jehol, *Sir George Staunton.*

From the fine specimens given me by Dr. Daniell I have slightly amended the character of this species: this was the more needed to separate it clearly from the following.

3. QUERCUS MCCORMICKII. Foliis breviter petiolatis obovatis, basi lobata, a medio ad basin cuneato-attenuatis sinuato-lobatis, lobis sursum versis rotundato-obtusis muticis a medio utrinque decrescentibus, sinubus acutioribus, subtus glaucis, glabris vel rarius subtus ad venas pilis raris obsitis; cupulæ squamis externis triangulatis sericeis, internis membranaceis lineari-lanceolatis margine et apice ciliatis cupulam valde excedentibus; nuce rotundata cupulæ squamas vix excedente styli basi apiculata.
*Hab.* From Taliewhan, *Dr. Daniell.*

The difference between the foliage of this species and the preceding is so trifling, that, but for the fruit, it would be difficult to separate them. The shape of the acorn, and especially the scales of the cup, however, supply obvious and striking peculiarities. Instead of the compact scales of *Q. Mongolica*, Fisch., the cup is nearer that of *Q. obovata*, Bge.; but the scales are more compact, shorter, and more erect.

4. Quercus serrata, *Thunb. Flor. Jap.* p. 176.
*Hab.* From Taliewhan, *Dr. Daniell.*

5. Quercus, sp.
*Hab.* From Taliewhan, *Dr. Daniell.*

This is a shrub, growing to the height of 6–10 feet. It appears to be nearly related to *Q. serrata*, Thunb., both having the leaves glabrous above and glaucous below, from a compact covering of small white hairs, and having also the veins running out into setæ; but the uniform obovate shape of the leaves, and the almost entire absence of the petiole (scarcely exceeding a line in length, as opposed to an inch in *Q. serrata,* Thunb.) strikingly separate it from that species.

6. Quercus, sp.

*Hab.* Taliewhan, *Dr. Daniell.*

This is also a dwarf oak, from 6 to 10 feet high. It differs from *Q. Chinensis,* Bge., which seems to be its nearest ally, in wanting the glaucous or canescent covering on the under surface of the leaf (both sides being equally glabrous, and nearly of the same colour), and in the remarkable panduriform shape of the nearly sessile leaf. The petiole is 1–2 lines long.

7. QUERCUS ACUTISSIMA. Foliis petiolatis, e basi rotundata vel obtusiuscula ovato-lanceolatis acutissimis serratis, serraturis setaceo-excurrentibus, venis et setis sursum spectantibus glabris; fructibus breviter pedunculatis; cupulæ squamis sericeis, externis parvis, internis elongatis subulatis cupulam excedentibus.

*Hab.* Chinese province of Kiangsi, *Sir George Staunton.*

The form of the leaf separates this species from the last, and the glabrous under-surface as well as the remarkable difference in the fruit separate it from *Q. serrata,* Thunb., under which name specimens of it have been distributed by Dr. Asa Gray. The veins and the setæ are directed more upwards than in the allied species. The petiole is 5–8 lines long.

## On the identification of the Grasses of Linnæus's Herbarium, now in possession of the Linnean Society of London. By Colonel WILLIAM MUNRO, 39th Regt., C.B., Chevalier of the Legion of Honour, F.L.S., &c.

[Read April 4th, 1861.]

I BEG to offer to the Linnean Society, as the envied possessors of the original authenticated collections of Linnæus himself, the accompanying notes on the identification of the various grasses contained in his Herbarium.

Hoping that ere very long I shall be able to offer to botanists a full account of all grasses at present known in collections, I have devoted considerable time to the identification of the species of the earliest authors, with the view of clearing up some of the numerous mistakes in synonymy, which add so very much to the labours of any systematic botanist who wishes to treat any natural order in a really scientific spirit. Amongst grasses I find the errors extraordinarily numerous. Many of these might have been avoided by consulting herbaria easily accessible; and very many might have been avoided by a little care, and less anxiety for the creation of species. With many, a difference in locality seems to have been quite sufficient reason for giving a different specific name. This idea was not consequent on following in Linnæus's steps. In the comparatively few mistakes he has made, he has erred in the contrary direction, and placed in one species two or three very different plants. In another respect Linnæus's example might have been well followed. He had great regard to the priority of names; and although he was the first to apply specific ones, he has frequently, as his MSS. show, altered his own, because he found previous terms, that would answer for specific and generic names, had been used by Gronovius, Scheuchzer, and others. Linnæus appears to have paid great attention to the Gramineæ. The specimens are in remarkably good condition, and in only two instances are they insufficient for absolute identification.

The numbers in the Herbarium refer to those used in the first edition of the 'Species Plantarum,' Linnæus's own copy being very carefully marked by himself. In the following list I have used these numbers, *underlining* them, as was done by Linnæus himself, thus 1, 2, &c., to imply that the plant was actually in the Herbarium. When Linnæus's name remains unaltered in the best authors of the present day, I have marked the plant with ! after the name, as, 1. *Lygeum Spartum*, L.! I have carefully examined every grass in the Herbarium; and in annexing the following list of names which I consider they should bear, I trust the list may be of some little use to botanists who are unable to consult the Herbarium itself. I have inserted all the names contained in the following works by Linnæus:—first, all in the 1st edition of the 'Species Plantarum,' published 1753; then all extra in the 2nd edition, published in 1762; then all in the two Parts of the 'Mantissa' (as far as p. 143 published in 1767, and from that to the end in 1771), which Linnæus styles a supplement to the 6th edition of the 'Genera Plantarum' and to the 2nd edition of the 'Species Plantarum.' I have also included all published in a paper entitled "A First and Second Century of Plants collected in various parts of the world, by Kalm, Osbeck, Loefling and others," in the 4th volume of the 'Amœnitates Academicæ' (1759), and, further, all grasses contained in a paper on the plants of Jamaica sent by Browne, in the 5th volume of 'Am. Acad.' (1760). These, with the exception of about half-a-dozen described in the 'Systema Naturæ,' also included in this list, appear to me to comprise all the grasses for the nomenclature of which Linnæus is personally responsible.

I have also occasionally added a few notes on some of the grasses of the younger Linnæus, which are in the Herbarium.

Stoke Bishop, near Bristol,
February 18th, 1861.

## Cinna, *Sp. Pl.* 1st edit. p. 5.

1. *Cinna arundinacea,* L.! The specimen is from the Upsal Garden, raised from seeds sent by Kalm from North America, where the plant is common. In the same envelope, without number or locality, is a specimen of *Hymenachne Myurus,* P. de B.

## Anthoxanthum, *l. c.* p. 28.

1. *A. adnatum,* L. The well-known vernal grass. The only species, in the Herbarium, of the genus.
2. *A. Indicum* is stated to be No. 25 Fl. Zeyl., which is in Hermann's Herb. vol. v. fol. 29, and is *Perotis latifolia,* Ait., very fairly figured by Plukenet, t. 119. f. 1.
3. *A. paniculatum,* described by Linn. as having 4-flowered spikes. I am unable to decide positively what this is; but Kunth is probably correct when he states it is a synonym of *Festuca spadicea,* Gouan.

## Nardus, *l. c.* p. 53.

1. *N. stricta,* L.!
2. *N. Gangitis* is *Lepturus incurvatus,* Trin. The specimen collected at Montpellier. Much confusion has been occasioned by the drawings erroneously quoted by Linnæus. Lobel, Icon. 84 is one of leaves only, and is, I believe, *Andropogon laniger,* Desf.; Morison, t. 13. f. 8 is *Ctenium Americanum*; hence Kunth quotes *N. Gangitis,* Linn., as a synonym of that plant. Why the name *Gangitis* was given to a plant collected in the South of France, it is difficult to explain, except from some confusion regarding Lobel's plant, which is one of those believed to produce the Nard of the ancients. The specimen is to be found amongst *Festuca,* q. v.
3. *N. ciliaris* is *Ischæmum leersioides,* Munro in Seemann's Herb.
4. *N. articulatus.* There is no specimen of this; and it is omitted in the 2nd edition.

*N. aristatus,* 2nd edit. p. 78, from Rome, is *Psilurus nardoides,* Trin.

*N. Indica,* Linn. Herb., is *Microchloa setacea,* R. Br.

*N. Thomæ,* Linn. Herb., is *Oropetium Thomæum,* Trin.

### Lygeum, *Sp. Pl.* 2nd edit. p. 78.

1. *L. spartum*, L.!

### Cornucopiæ, *Sp. Pl.* 1st edit. p. 54.

1. *C. cucullatum*, L.!

*C. alopecuroides*, Mant. p. 28 (1767), is *Alopecurus utriculatus*, Pers.

### Saccharum, *l. c.* p. 54.

1. *Saccharum officinarum*. The specimen marked by Linnæus himself is not the true Sugar-cane, but is *Erianthus Japonicus*, P. de B. It is also wrongly marked in pencil, "*Sacch. polystachyum*, Sw.?" which is *Panicum ferrugineum*, Kunth. The reference to Sloane, Jam. p. 108, t. 66, is correct, that being a very fair drawing of the true Sugar-cane.

2. *S. spicatum* is *Imperata arundinacea*, Cyrill. One specimen is from C. B. S., and another has been named by Smith *Perotis latifolia*, *β*, Willd., i. 324, where, however, the confusion is very great, two or three different plants being confounded together.

*S. spontaneum*, L.! Mant. p. 183, from Koenig.

*S. Ravennæ*, Linn. Herb., is *Erianthus Ravennæ*.

### Phalaris, *l. c.* p. 54.

1. *P. Canariensis*, L.!

2. *P. phleoides* is *Phleum Boehmeri*, Wib.

3. *P. arundinacea*, L.!

4. *P. erucæformis* is *Beckmannia erucæformis*, Host.

5. *P. oryzoides*. One, from Gronovius, is *Leersia oryzoides*, Sw.; another specimen, from Browne, is *Leersia hexandra*, Sw.

The following also in Herbarium:—

*P. bulbosa*, Amœn. Acad. iv. 264; 2nd edit. Sp. Pl. p. 79, is *Phleum tenue*, Schrad.

*P. aquatica*! Am. Ac. *l. c.*

*P. zizanioides*, Mant. 183, is *Andropogon muricatus*, Retz.

*P. tuberosa*, Mant. 557, is marked by Smith as *P. nodosa*, Syst. Veg., and is the plant now so called.

*P. paradoxa*, Linn. Herb., from Upsal Garden, is the plant so called now. In MS. notes to 1st edit. it is called by Linn. *P. utriculosa*, with a marginal note "*P. paradoxa*, 1665."

### Paspalum

is not a genus of the 1st edit., but appears in the 2nd, p. 81; and the following species are in the Herbarium:—

*P. dissectum*, L.! From North America, *Kalm*. This was published in 1st edit. Sp. Pl. p. 57, as *Panicum dissectum*. Pinned to this is a specimen of *Paspalum conjugatum*, Berg.

*P. virgatum*, L.! From Browne, well figured by Sloane, t. 69. fig. 2.

*P. paniculatum*, L.! Another specimen, pinned to this, and also marked *paniculatum*, is *Paspalum fluitans*, Kunth.

*P. distichum*! Amœn. Acad. v. 391, from Jamaica, *Browne*.

*P. scrobiculatam*, L.! Mant. 29. Raised in the Upsal Garden, from seeds received from India.

A plant marked by Linn. "*Paspalum*," and by Smith "*pubescens*, Br. Prod. i. 188?" is *Paspalum granulare*, Trin.

In the same envelope, merely marked C. B. S., is a specimen of *Eustachys petræa*, Desv.

## PANICUM, *Sp. Pl.* 1st edit. p. 55.

1. *P. alopecuroideum* is *Gymnothrix Thouarii*, P. de B. Received by Linnæus from China. The reference to Plukenet, t. 119. f. 1, is incorrect, as that is *Perotis latifolia*, Ait. The reference in 2nd edit. f. 82, to Pluk. t. 92. f. 5, is probably correct.

2. *P. polystachyum*. The specimen is *Pennisetum barbatum*, Schult. Another, from the Upsal Garden, is *Setaria glauca*, P. de B., stated to have been raised from American seeds. Another is *Setaria viridis*, P. de B., and another, also marked 2, and pinned to the others, is *S. verticillata*, P. de B.

3. *P. Americanum*. There is no specimen in Herb.; and the plant is omitted in the 2nd edition.

4. *P. Italicum* is *Setaria Italica*, Kunth. Another specimen, from Upsal Garden, is named *P. Germanicum* by Linnæus.

5. *P. Crus Galli*, L.! A small state, from Kalm.

6. *P. dissectum*. Already referred to as *Paspalum dissectum*.

7. *P. dimidiatum* is *Stenotaphrum Americanum*, Schrank. The specimen from India.

8. *P.* (*Digitaria*) *sanguinale*! L.

9. *P. filiforme*, from Kalm, is *Paspalum filiforme*, Sw. This contains also a piece of *Muhlenbergia diffusa*, Willd. Another sheet, from Upsal Garden, contains *P. sanguinale*, L.

10. *P. compositum*. The plant was originally described from Fl. Zeyl. 42, and is what is now called *Oplismenus compositus*; but the specimen in the Herbarium is *Oplismenus Burmanni*.

11. *P. dichotomum*, L.! From Kalm, and is the plant described by A. Gray as *dichotomum*.

12. *P. clandestinum*, L.! From Kalm also, a form of *P. latifolium*, L. Linnæus's reference to Sloane, t. 80, is erroneous, as that is a species of *Manisuris*.

13. *P. capillare*, L.! From the Upsal Garden.

14. *P. patens*, L.!

15. *P. dactylon* is *Cynodon dactylon*, Pers.

16. *P. miliaceum*, L.!

17. *P. latifolium*, L.! From Kalm, North America. A specimen attached to this from Carolina is *P. divaricatum*, L., to which Sloane's figure, t. 71. f. 3, belongs; another, marked *latifolium*, is *P. oryzoides*, Sw.

18. *P. brevifolium*, L.! Allied to *P. patens*. The specimen was from India; but the reference to Plukenet, t. 189, f. 4, is erroneous, that being *Isachne australis*.

19. *P. arborescens* is *P. notatum*, Retz. Obs. iv. 18, and is very different from the *arborescens* of Fl. Zeyl. 43, of which there is a specimen in Hermann's Herb., and is probably *P. patens*. On the same sheet in Linnæus's Herb. are some portions of a species of *Arundinaria*, which may have been the origin of *arborescens*.

20. *P. virgatum*, L.! From Gronovius.

*P. verticillatum*, 2nd edit. p. 82, is *Setaria verticillata*: vide No. 2, ante.

*P. glaucum*, *l. c.* 83, is *S. glauca*, P. de B.

*P. viride*, *l. c.* 83, is *S. viridis*, P. de B.

*P. hirtellum*, Am. Acad. v. 391, from Jamaica, is *Oplismenus Burmanni*, P. de B.

*P. Crus Corvi*, L.! 2nd edit. p. 84. From a garden.

*P. colonum*, L.! 2nd edit. p. 84, also marked *P. brizoides*. One from Browne is true *colonum*; another, marked *colonum*, is *Echinochloa Crus Galli*.

*P. lineare*, *l. c.* p. 85.

*P. grossarium*, L.! Am. Acad. v. 392. This plant is often called *P. pubescens*.

*P. divaricatum*, L.! Am. Acad. v. 392. From Jamaica. This plant has often been confounded with *P. latifolium*, and bears the names of *P. ruscifolium*, *maculatum*, *glutinosum*, and *agglutinans*. Another specimen of *divaricatum* is marked *arborescens* by Smith.

*P. repens*, L.! 2nd edit. Sp. Pl. p. 87. This is *P. arenarium*, Brotero.

*P. brizoides*, Mant. 184, is *P. colonum*. See above.

*P. conglomeratum*, Mant. 324, is, I suppose, the same as *P. Indicum*; there is, however, no specimen so marked.

*P. distachyon*, L.! Mant. 183. Closely allied to *P. Petiverii*, Trin., with only two spikes.

*P. ramosum*, L.! Mant. 29, from the Upsal Garden. A common species in India, closely allied to *P. grossarium*.

*P. coloratum*, L.! Mant. 30, from Upsal Garden. This approaches *P. virgatum* very closely, and is unlike any uncultivated plant I have seen. Smith quotes Jacquin, Icon. Rar. i. t. 12.

*P. curvatum*, L.! Syst. Nat. xii. 732, is a loosely flowered state of what is usually called *P. interruptum*, Willd. The specimen is marked by Smith as "*Holcus striatus*."

*P. Indicum*, L.! Herb. Linn., Mant. 184, from Koenig. This is also marked *Panicum Johannæ*. A very small simple state.

*P. incurvum*, Linn. Herb., is a hairy-glumed state of the preceding, also marked by Smith as *Holcus striatus*.

*P. musciparum*, Linn. Herb., which I cannot find described anywhere, is *P. miliare*, Lam.

*P. oryzoides*, Herb. Linn., marked "Ard. Spec. 2, t. 5," is *Echinochloa stagnina*, P. de B.

No. 516, placed in *Panicum*, is *Sporobolus Indicus*, R. Br.; and

No. 513, also so placed, is *Eragrostis brizoides*, N. ab E.

### PHLEUM, *Sp. Pl.* 1st edit. p. 59.

1. *P. pratense*, L.!
2. *P. alpinum*, L.!
3. *P. arenarium*, L.!
4. *P. schœnoides* is *Crypsis schœnoides*, Lam.

*P. nodosum*, Sp. Pl. 2nd edit. p. 88, is only a form of *P. pratense*.

### ALOPECURUS, *l. c.* p. 60.

1. *A. pratensis*, L.!
2. *A. geniculatus*, L.!
3. *A. hordeiformis* is *Gymnothrix cenchroides*, R. et Sch.
4. *A. Monspeliensis* is *Polypogon Monspeliensis*, Desf.

*A. agrestis*, L.! 2nd edit. p. 89.

*A. paniceus*, 2nd edit. p. 90, is called *Cynosurus paniceus* in 1st edit., and is *Polypogon maritimus*, Willd.

*Alopecuroides*, so marked in Linn. Herb., is *Gymnothrix Thouarii*, P. de B.; and another so called is *Penicillaria spicata*, Willd., marked by Smith as "*Alopecurus indicus*, Syst.Veg., sent by Afzelius as *Holcus spicatus mas*."

### MILIUM, *Sp. Pl.* 1st edit. p. 61.

1. *M. effusum*, L.!
2. *M. confertum* is *Piptatherum*.

*M. paradoxum*, 2nd edit. p. 90, called *Agrostis paradoxa* in 1st edit., is *Piptatherum paradoxum*, P. de B.; and one pinned to it, from Carniola, is *Piptatherum virescens* of Trin.

*M. lendigerum*, 2nd edit. p. 91, is *Gastridium australe*, P. de B.

*M. punctatum*, Am. Acad. v. 392, from Jamaica, Browne, is *Helopus pilosus*, Trin.

*M. capense*, Mant. 185, is *Danthonia (Pentaschistis) papillosa*, N. ab E., or an allied species.

### AGROSTIS, *l. c.* p. 61.

1. *A. Spica Venti* is *Apera Spica Venti*, P. de B.
2. *A. miliacea*, from Upsal Garden, is *Piptatherum multiflorum*, P. de B., as also is another, marked *A. sepium*.
3. *A. arundinacea* is *Deyeuxia sylvatica*.
4. *A. rubra*. Not in Herb.
5. *A. canina*, L.! Smith has marked one specimen of this "*capillaris*, Huds. nec Linn.; *Agrostis vulgaris*, Fl. Brit.; *tenuis*, Sibth."
6. *A. paradoxa* is *Milium paradoxum*, referred to above.
7. *A. stolonifera*. The Herbarium contains one of the forms of *A. vulgaris*, which is called *stolonifera*, the Fiorin Grass; another, marked *stolonifera* by Linn., is *A. verticillata*, Vill.
8. *A. capillaris*, L.!
9. *A. alba*, L.! An unawned state; and pinned to it is a specimen of *A. canina*.
10. *A. minima* is *Mibora verna*, Adans.
11. *A. Virginica* is *Vilfa Virginica*, P. de B.; and pinned to it is a specimen from Kalm of *Sporobolus heterolepis*, A. Gray.
12. *A. Indica*, from Browne, is *Sporobolus Indicus*, R. Br.; and pinned to it is a specimen of *Polypogon Monspeliensis*, Desf., also marked by Linn. "*Indica* 12." The reference to Pluk. t. 191. f. 5, is erroneous, as that is *Heteropogon contortus*.

*A. Calamagrostis*, Sp. Pl. 2nd edit. p. 92. Not in Herb.

*A. interrupta*, Sp. Pl. 2nd ed. p. 92. Not in Herb.

*A. radiata*, Am. Acad. v. 392, from Browne, is *Chloris radiata*, Sw.

*A. cruciata*, Sp. Pl. 2nd ed. p. 94, from Browne, is *Chloris cruciata*, Sw.

*A. bromoides*, Mant. 30, is *Aristella bromoides*, Bertol.

*A. australis*, Mant. 30, is *Gastridium australe*, P. de B.

*A. serotina*, *l. c.* 30, is *Diplachne serotina*, Link.

*A. Matrella*, *l. c.* 185, is *Zoysia pungens*, Willd.

*A. pumila*, L.! *l. c.* 31, I think a good species, although included by Kunth and others in *A. vulgaris*. It is about 3 inches high.

*A. Mexicana*, *l. c.* 31, from Upsal Garden, is *Muhlenbergia Mexicana*, Trin.

*A. Cornucopiæ*, Linn. Herb., from Kalm, is the plant properly so called now, and which has been subdivided into *A. laxiflora*, *A. scabra*, *A. Michauxii*, &c. The naming is not in Linnæus's handwriting.

*A. tenacissima*, Linn. Herb., is *Muhlenbergia sobolifera*, Trin.

*A. maritima*, Linn. Herb., from Klein, is *Vilfa pungens*, P. de B., also *Phalaris disticha*, Forsk.

*A. aurea*, Hall, 1498, is *Agrostis setacea*, Curtis.

*A.* No. 20 is *Hymenachne Myurus*, P. de B.

*A.* without a specific name is *Leptochloa virgata*, P. de B.

The same envelope contains a species of *Chusquea* from Browne, a specimen of *Poa nemoralis*, of *Deyeuxia neglecta*, and *Festuca sylvatica*, none named.

### AIRA, *Sp. Pl.* 1st edit. p. 63.

1. *A. spicata*. In the 2nd edition this name is altered to *A. Indica*. It is *Panicum Indicum*, L. The specimen is marked by Linn. "*Panicum*," and a reference is made to Mant. 184, where the plant is described as *Panicum Indicum*. *A. spicata* of 2nd edition, p. 95, is *Trisetum subspicatum*, P. de B.

2. *A. cristata*. Not in Herb. Probably *Kœleria aristata*. See No. 12, below.

3. *A. cærulea* is *Molinia cærulea*, Mœnch.

4. *A. arundinacea*. Not in Herb.

5. *A. minuta*. A small state of *Airopsis agrostidea*, Cand.

6. *A. aquatica* is *Catabrosa aquatica*, P. de B.

7. *A. subspicatum* is *Trisetum subspicatum*, P. de B.

8. *A. cæspitosa* is *Deschampsia cæspitosa*, P. de B. A viviparous speci-

men from Lapland is marked by Smith as "*lævigata* fide Don ;" a species of *Poa nemoralis* is pinned to it.

9. *A. flexuosa* is *Deschampsia flexuosa.*

10. *A. montana.* Part is *Agrostis rupestris*, All.; part is *Poa flexuosa*, Wahl.; and another, marked "from China, Osbeck," is *Eriachne Hookeri*, Munro in Hb. Hooker., from Assam and Tenasserim.

11. *A. alpina* is *Deschampsia alpina.*

12. *A. canescens* is *Corynephorus canescens*, P. de B.; and pinned to it are two specimens of *Kœleria cristata*, which probably belong to No. 2.

13. *A. præcox*, L.!

14. *A. caryophyllea*, L.! Pinned to it is a specimen of *Poa annua.*

*A. capensis*, Linn. Herb., is *Ehrharta calycina*, Sm. The same envelope contains a specimen of *Sporobolus Indicus*, and a *Brizopyrum* from C. B. S.

## MELICA, *Sp. Pl.* 1st edit. p. 66.

1. *M. ciliata*, L.!

2. *M. nutans*, L.!

3. *M. altissima*, L.!

*M. papilionacea*, L.! Mant. 31. From Brazil, *Arduin.* Linnæus also called this, in MS., *M. spectabilis.*

*M. minuta*, L.! Mant. 32.

*M. Falx*, Linn. fil. Supp. 109, is *Harpechloa capensis*, Kunth.

*M. cynosuroides*, Linn. Herb., is *Enteropogon melicoides*, Nees.

## POA, *l. c.* p. 67.

1. *P. aquatica* is *Glyceria aquatica*, Sm.

2. *P. alpina*, L.! Two specimens, one of which is from Lapland, are true *P. alpina*; and there are two of *P. trivialis.* Linn. in MSS. says *alpina* may be a form of *trivialis.*

*β. vivipara.* Of this there are three sheets, all *P. alpina*, except part of one, which is *Festuca ovina* viviparous.

3. *P. trivialis*, L.!

4. *P. angustifolia.* One specimen is *P. pratensis*, var. *angustifolia*; and another, pinned to it, is *P. nemoralis*; another is *P. annua.*

5. *P. pratensis*, so marked by Linn. fil., is *P. alpina.*

6. *P. annua*, L.!

7. *P. flava,* marked Gron. Virg. 13, is *Poa crocata,* Michx.; but that name should be altered to *P. flava.*

8. *P. pilosa.* Not in Herb.

9. *P. amabilis,* L.! This is the plant which is generally called *P.* (*Eragrostis*) *plumosa,* Link. It is also Hermann's species (fide Herb. ii. 59!) from which *Fl. Zeyl.* 46 is described, and is Pluk. t. 300. f. 2, marked in the margin, by Linnæus himself, *P. amabilis,* and to be found in Plukenet's Herb. i. 187, from Cape Comorin. The plant generally called *P. amabilis* is *P.* (*Erag.*) *unioloides,* and is also to be found in Plukenet's Herb. *l. c.*

10. *P. Eragrostis,* L.!

11. *P. capillaris,* L.! One from Kalm; another from Sloane, figured at t. 72; and another from Upsal Garden: all true *P.* (*Erag.*) *capillaris.*

12. *P. Malabarica* is *Panicum Arnottianum,* Nees. The reference to Rheede is correct; it is a very fair drawing.

13. *P. Chinensis,* sent by Osbeck from China, is *Leptochloa Chinensis,* Nees.

14. *P. tenella.* There is much confusion about this plant. There is no specimen in the Herb. of what is now considered *tenella.* One from India marked *tenella* by Linn. is the same as No. 9, above, *P. amabilis*; and Linnæus has written a long MS. description on the specimen. Rumph. Amb. 6, t. 4. f. 3, is a good drawing, and is marked by Linnæus himself as *Poa tenella.* Rheede, if correctly quoted, is a miserable drawing. Pluk. t. 300. f. 2 is *P. amabilis.* I therefore consider that all above belong to *P. amabilis,* and that the *P. tenella* ultimately intended by Linnæus is what is now called *Eragrostis tenuissima,* Schrad., is Pluk. t. 190. f. 4, and is in his Herb. i. 186!

15. *P. compressa,* from Upsal Garden, is ordinary *Poa pratensis.*

16. *P. nemoralis,* L.! Seven sheets are correct; one, also so marked, from Kalm, is *Reboulea gracilis,* Kunth; *Reboulea truncata,* Torr.

17. *P. bulbosa,* L.! All viviparous except one specimen with very narrow leaves and extremely similar to *P. ligulata,* Boiss.

*P. palustris,* 2nd edit. Sp. Pl. p. 98. Not in Herb.

*P. rigida,* Am. Acad. iv. 265, is *Festuca rigida,* Kunth.

*P. ciliaris,* L.! Am. Acad. v. 392. From Jamaica, *Browne.*

*P. spicata,* Mant. 32. Not in Herb.

*P. distans,* Mant. 32, is *Sclerochloa arenaria,* Nees. This is marked by Linnæus "*Aira aquatica.*"

A plant marked *Poa* by Linn., and *Aira cristata*, No. 14, by some other person, is *Kœleria cristata*, Pers.

" *Poa juncea*, &c., Hall. Hist. 1459," is *Festuca spadicea*, Gouan. The same envelope also contains a specimen of *Poa arctica* and *Eragrostis bifaria*, Vahl, both unnamed.

### BRIZA, *Sp. Pl.* 1st edit. p. 70.

1. *B. minor*, L.!
2. *B. media*, L.!
3. *B. maxima*, L.!
4. *B. Eragrostis*. One specimen from Kalm, and one marked " Morison, Hist. 204, t. 6. f. 52," are both *Poa Eragrostis*, L.! One marked C. B. S. 384, is *Eragrostis Chapellieri*, Kunth.

*B. virens*, 2nd edit. p. 103, is merely a form of *B. media*. One specimen is marked by Linnæus " *B. anceps*."

### UNIOLA, *l. c.* p. 71.

1. *U. paniculata*, L.! Pluk. t. 32. f. 6 is a good drawing.
2. *U. spicata*, L.! One from Kalm is *Poa Michauxii*, Kunth; another, from Siberia, Pallas, is *Æluropus brevifolius*, Trin.

*U. bipinnata*, 2nd edit. p. 104, is *Poa* (*Eragrostis*) *cynosuroides*, Retz.

*U. mucronata*, *l. c.*, is not in the Herbarium.

### DACTYLIS, *l. c.* p. 71.

1. *D. cynosuroides* is *Spartina cynosuroides*, Willd.
2. *D. glomerata*, L.!

*D. ciliaris*, Mant. 185, from C. B. S., is *Lasiochloa ciliaris*, Kunth.

*D. lagopoides*, Mant. 33, is *Æluropus lævis*, Trin.

Another, marked, but not by Linn., " *Dactylis paleacea*, 296," is *Kœleria cristata*, Pers.

### CYNOSURUS, *l. c.* p. 72.

1. *C. cristatus*, L.!
2. *C. echinatus*, L.!
3. *C. Lima* is *Wangenheimia disticha*, Mœnch.
4. *C. durus* is *Sclerochloa dura*, P. de B.
5. *C. cæruleus*. One specimen is *Sesleria cærulea*, Arduin; the other is *S. sphærocephala*, Arduin.

6. *C. Ægyptiacus* is *Dactyloctenium Ægyptiacum,* Willd. There are one erect and one procumbent form of the same from Jamaica (Browne).

7. *C. Indicus* is *Eleusine Indica,* Gærtn. One specimen, sent from Browne.

8. *C. paniceus* is *Polypogon Monspeliensis,* Desf., omitted in 2nd edition.

9. *C. aureus* is *Lamarckia aurea,* Mœnch.

*C. virgatus,* Am. Acad. v. 393, from Jamaica (Browne), is *Leptochloa virgata,* P. de B.

*C. Coracanus,* Sp. Pl. 2nd ed. p. 106, is *Eleusine Coracana,* Gærtn.

*C. Uniolæ,* Linn. fil. Supp., is *Brizopyrum unioloides,* Nees; and this contains a small scrap of *Cynodon Dactylon,* Pers.

## FESTUCA, *Sp. Pl.* 1st edit. p. 73.

1. *F. ovina,* L.! Correct, except one from Kalm, which is *F. tenella,* Willd. Another in the Herbarium, marked *F. varia,* Hall. 1439, is also *ovina.*

2. *F. duriuscula,* L.!

3. *F. rubra,* L. has very hairy spiculæ. Linn. in a MS. note says it is a variety of *duriuscula.* One pinned to it is marked by Linn. *F. dumetorum,* and is certainly only *rubra.*

4. *F. amethystina.* Not in Herb.

5. *F. Myurus,* L.! A very small dwarf state.

6. *F. maritima.* Not in Herb.

7. *F. bromoides,* L.! In my opinion, the same as No. 5.

8. *F. decumbens* is *Triodia decumbens,* P. de B.

9. *F. elatior,* L.! Another sheet of this is marked "*F. palustris,* No. 26."

10. *F. fluitans* is *Glyceria fluitans,* Br.

11. *F. cristata,* also marked by Linn. "*Poa cristata,*" is *Kœleria phleoides,* Pers., also marked by Linn., on the back of the sheet, "*Alopecurus Monspeliensis.*"

*F. reptatrix,* 2nd edit. Sp. Pl. p. 108, from Egypt, is *Diplachne fusca,* P. de B.

*F. fusca, l. c.* 109, is the same plant.

*F. calycina, l. c.* 110, is *Schismus marginatus,* P. de B. This is also marked "12. *F. barbata.*"

*F. decumbens*, *l. c.* 110. Not in Herb.

*F. serotina*, *l. c.* 111. Not in Herb.

*F. dumetorum*, *l. c.* 109. Already mentioned under No. 3.

*F. spadicea*, L.! Syst. Nat. 732.

*F. phœnicoides*, Mant. 32. Not in Herb.

There is also a specimen of *F.* [*Vulpia*) *ciliata* not marked by Linn.; also one of *Sclerochloa arenaria*; another, marked "*F.* Hall. Hist. 1445," is *Kœleria cristata*; another, unnamed, is *Festuca borealis*, Mert. & Koch.

*F. spinosa*, Linn. fil. Supp. 111, is *Eragrostis spinosa*, Pers.

In this envelope, but why placed here I know not, is part of a plant marked "*Nardus spuria Gangitis*, Lobel." It is the lower portion of the culm of *Andropogon laniger*, Desf., known in commerce as *Schœnanthus*, &c.

## BROMUS, *Sp. Pl.* 1st edit. p. 76.

1. *B. secalinus*, L.! Pinned to it a specimen of *B. mollis*, marked "*B. hordeaceus*, No. 32."

2. *B. squarrosus*, L.!

3. *B. purgans*, from Upsal Garden, is the same as No. 4.

4. *B. ciliatus*, L.! From Kalm, and his seeds raised in Upsal Garden. One marked *B. ciliatus* by Smith is *B. rubens*.

5. *B. sterilis*, L.!

6. *B. arvensis*, L.! marked by Smith "Cav. Ic. 590."

7. *B. tectorum*, L.!

8. *B. hordeaceus*. Omitted in 2nd edition, and referred to *B. mollis*, which it is.

9. *B. giganteus*, from Arduin, is *Festuca gigantea*, Vill.

10. *B. pinnatus* is *Brachypodium pinnatum*, P. de B.

11. *B. cristatus* is *Triticum cristatum*, Schreb. In the MS. notes of 2nd edition it is transferred to *Triticum*.

*B. mollis*, L.! 2nd edit. p. 112. One small specimen is marked "*B. nanus*, Weigel."

*B. Madritensis*, L.! Am. Acad. iv. 265. From Upsal Garden; another specimen, marked "No. 35 *Bromus erectus*, R. Syn.," is also this.

*B. rubens*, L.! Am. Acad. iv. 265. From Spain.

*B. scoparius*, L.! Am. Acad. *l. c.* The true plant from Spain; another marked *scoparius* is *B. Japonicus*.

*B. racemosus*, L.! 2nd edit. Sp. Pl. p. 114. Linnæus has marked one specimen *B. secalinus.*

*B. triflorus*, *l. c.* p. 115. Not in Herb.

*B. distachyos*, Am. Acad. iv. 304, is *Trachynia distachya*, Link. One specimen is marked by Linn. as his *Secale bromoides*; and another, pinned to it, No. 36, from England, is *Brachypodium sylvaticum.*

*B. inermis*! Mant. 186, is in Herb.; but no specimen is so marked by Linnæus.

*B. ramosus.* There is much confusion, again, about this plant. The plant described in Mant. 34, sent from the East, and marked "Allioni, 2233, from Scheuchzer," is *Brachypodium ramosum*, R. et Schultes, the term *ramosus* being applicable to the stem. The only plant marked *ramosus* by Linn. is *Bromus asper* of Murray, sent by Schreber.

*B. geniculatus*, Mant. 33, is *Festuca* (*Vulpia*) *geniculata*, Willd.

*B. rigens*, Mant. 33, is a hairy-glumed state of *B. scoparius*, L.

*B. stipoides*, Mant. 557, is *F.* (*Vulpia*) *geniculata*, Willd.

There is also a specimen of *B. erectus*, Huds., marked "*B. agrestis*, Allioni." A specimen of *Brachypodium sylvaticum* is marked "*Bromus gracilis*, Weigel."

### STIPA, *Sp. Pl.* 1st edit. p. 78.

1. *S. pennata*, L.!

2. *S. juncea*, L.! One is correct, and one specimen is *S. sparta*, Trin., with much smaller flowers.

3. *S. avenacea*, L.! "Virg. Gron. 133." This is also marked "No. 3. *capillata*."

*S. capillata*, L.! 2nd edit. p. 116. There is a specimen not named.

*S. tenacissima*, Am. Acad. iv. 266, is *Macrochloa tenacissima*, Kunth.

*S. membranacea*, 2nd edit. p. 116, is *Festuca* (*Vulpia*) *uniglumis*, Solander.

*S. arguens*, *l. c.* p. 117, is *Anthistiria ciliata*, Linn. fil.

*S. Aristella*, Syst. Nat. iii. 229, is *Aristella bromoides*, Bertol.

*S. Spinifex*, Mant. 34, is *Spinifex squarrosus*, Linn. fil.

*S. spicata*, Thunb. 378, is *Heteropogon hirtus*, Pers.

There is also a specimen of *Lasiagrostis Calamagrostis*, Link, without a name.

### AVENA, *l. c.* p. 79.

1. *A. Sibirica*, from Gmelin, is *Stipa Sibirica*, Lam.

2. *A. elatior* is *Arrhenatherum avenaceum*, P. de B.

3. *A. Pennsylvanica*, from Kalm, is *Trisetum palustre* of Trinius and American authors.

4. *A. Lœflingiana*, from Spain, is *Trisetum Lœflingianum*, P. de B.

5. *A. sativa*, L.! One specimen is marked by Linn. *A. ponderosa*.

6. *A. fatua*, L.! One sheet marked 6 is *A. barbata*, Brot.

7. *A. flavescens* is *Trisetum flavescens*, P. de B. Pinned to it a specimen of *A. pratensis*.

8. *A. fragilis* is *Gaudinia fragilis*, P. de B.

9. *A. pratensis*, L.! Some specimens are also marked "*spicata*," which they are not.

10. *A. spicata*, from Kalm, is *Danthonia spicata*, N. et Sch., also marked "*bromoides*."

*A. nuda*, Am. Acad. iii. 401, is an unnamed state of *A. sativa*.

*A. sterilis*, L.! 2nd edit. Sp. Pl. p. 118, is probably only a form of *A. fatua*. One pinned to it, also marked *A. sterilis*, is *Macrochloa arenaria*, Kunth.

*A. sesquitertia*, Mant. 33. No specimen in Herb.

*A. pubescens*, L.! 2nd edit. Sp.Pl. 1665, is only a form of *A. pratensis*, as Linnæus in a MS. note suggests: he has also marked it "*Avena* near *sesquitertia*."

*A. stipiformis*, Mant. 34. Not in Herb.

*A. patula*, Hall. Hist. 1489, from Dick, is a small state of *A. pratensis*.

*A. bromoides*, Sp. Pl. 1666, is *A. pratensis*, L.

*A. hispida*, Thunb., is *Tristachya leucothrix*, N. ab E.

There are four species of *Danthonia* from C. B. S. without names, but probably sent by Thunberg. The same envelope contains a specimen of *Andropogon Schœnanthus*, a scrap of *Diectomis fastigiata*, and of *Bromus squarrosus*.

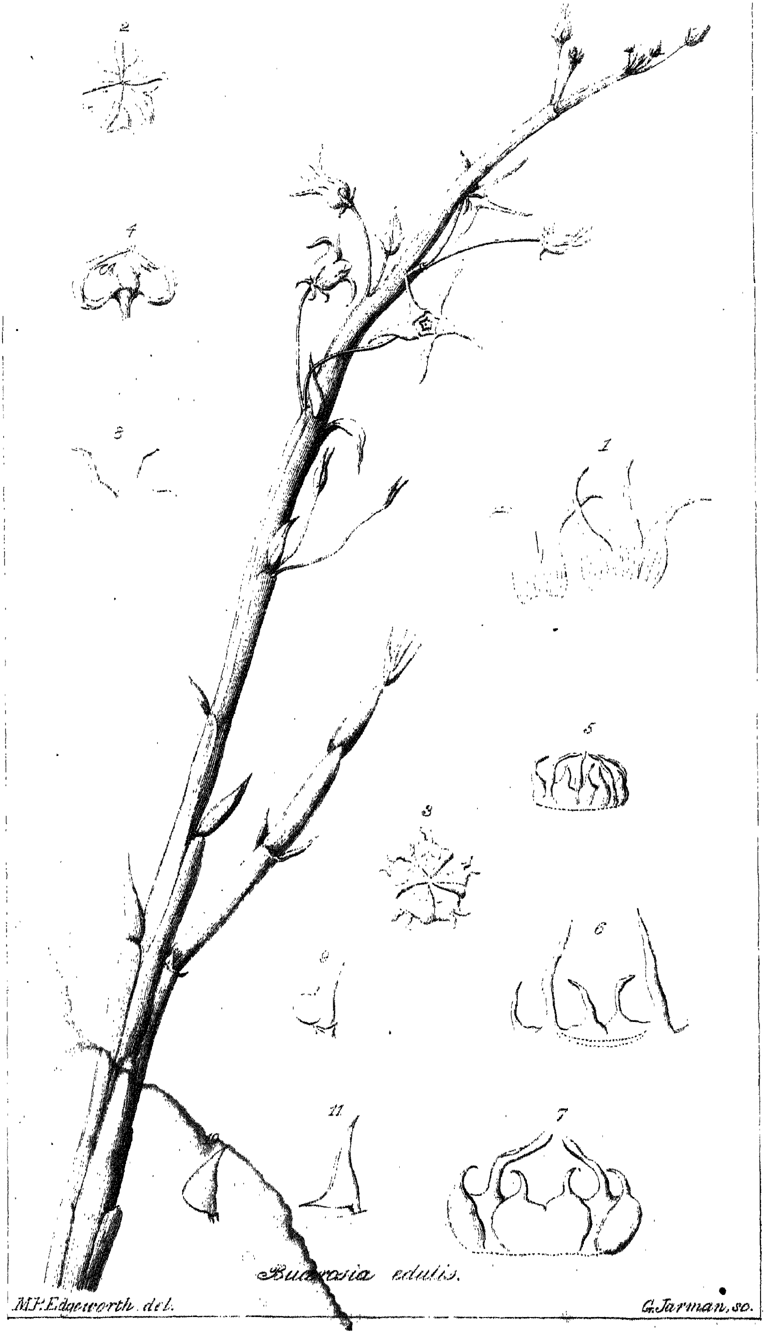
### LAGURUS, *Sp. Pl.* 1st edit. p. 81.

1. *L. ovatus*, L.!

*L. cylindricus*, 2nd ed. p. 120, is the large European form of *Imperata arundinacea*, Cyrill.

### ARUNDO, *l. c.* p. 81.

1. *A. Bambos* is *Bambusa arundinacea*, Willd. The leaves attached are small, and the stipules spinous.



*Boucerosia edulis.*

M.P. Edgeworth del.

G. Jarman, sc.

2. *A. Donax,* L.! Both specimens are marked "Kl.," which, I suppose, indicates Klein. One is real *A. Donax*; the other is *Phragmites communis,* Trin.

3. *A. Phragmites,* from Browne and from Ind. or., are *Phragmites communis,* Trin. A much expanded state is marked "*Phrag. arundinacea,* Allam. Ep. ad Linn. 1770."

4. *A. epigejos.* The first marked by Linn. "*epigejos*" is *Phragmites.* Pinned to it are specimens of *Deyeuxia montana,* Poir., one marked on the back "*A. montana,* Fl. Suec.;" and one is *Calamagrostis lanceolata,* Roth.

5. *A. Calamagrostis* is *Calamagrostis epigejos,* Roth. Awn basal, with hairs longer than the flower. Another marked "*A. Calamagrostis*" is *Lasiagrostis Calamagrostis,* Link.

6. *A. arenaria* is *Ammophila arundinacea,* Host.

## ARISTIDA, *Sp. Pl.* 1st ed. p. 82.

1. *A. Adscensionis,* L.! Linn. remarks that this is one out of four plants which constitute the flora of the Island of Ascension, the others being *Sherardia fruticosa, Euphorbia origanoides,* and *Portulaca.*

*A. Americana,* L.! Am. Acad. v. 393. From Jamaica, Browne. This is called *A. dispersa* by Trin.; but Linnæus's name ought to take precedence. Kunth has misplaced the Linnean synonym in *Eutriana juncifolia.*

*A. plumosa,* L.! 2nd edit. Sp. Pl. p. 1666, from Armenia, is *Aris.* (*Stipagrostis*) *plumosa.*

*A. arundinacea,* Mant. p. 186, from Koenig, is *Arundo Madagascariensis,* Kunth.

There is a specimen of *Aristida Hystrix,* from Thunb., and another, marked No. 47, var. β, is *A. vestita,* Thunb.

## LOLIUM, *Sp. Pl.* 1st ed. p. 83.

1. *L. perenne,* L.!

2. *L. temulentum,* L.!

*L. tenue,* 2nd ed. Sp. Pl. 122, is merely a form of *L. perenne.*

*L. distachyon,* Mant. p. 186, from Koenig, is *Digitaria ciliaris,* Pers.

## ELYMUS, *Sp. Pl.* 1st ed. p. 83.

Linnæus has not attached his usual mark to the five following as being in his Herbarium; but they are all present:—

1. *E. arenarius,* L.!

2. *E. Sibiricus,* L.!

3. *E. Canadensis,* L.!

4. *E. Virginicus*, L.!

5. *E. Caput Medusæ*, L.!

*E. Philadelphicus*, Am. Acad. iv. 266, from Canada, is the same as No 3 (*E. Canadensis*).

*E. Hystrix*, L.! Sp. Pl. 2nd ed. p. 124. From Gronovius.

*E. caninus*, Fl. Suec., 2nd ed. Sp. Pl. p. 124. Two specimens marked "B and 37," from England, are *Triticum caninum*, Schrad. One marked "*Gmelin* 23" is *Trit. repens*; another marked "*Gm.* 25" is *Elymus Sibiricus*.

*E. Europæus*, L.! Mant. 35.

### SECALE, *Sp. Pl.* 1st ed. p. 84.

1. *S. cereale*, L.!

2. *S. villosum*. Not in Herb.

3. *S. orientale*. Not in Herb.

4. *S. creticum*. One was originally so marked by Linn., but was scratched through. It is *Triticum villosum*, P. de B.

### HORDEUM, *Sp. Pl.* 1st ed. p. 84.

1. *H. vulgare*, L.!

2. *H. hexastichon*. Not in Herb.

3. *H. distichon*. Not in Herb.

4. *H. Zeocriton*, L.! Awn of the central spicula 4–5 inches.

5. *H. murinum*, L.! Intermediate glumes sometimes fringed.

6. *H. jubatum*, L.! From Kalm.

*H. bulbosum*, Am. Acad. iv. 304. Has a very remarkable bulbous stem; but I believe it to be only a variety of *H. murinum*.

*H. nodosum*, 2nd edit. Sp. Pl. p. 126, is certainly *H. pratense*, Huds., of which there are also two other specimens without any name, and the species does not seem to have been taken up by Linnæus.

A plant marked 101 is *Secale cereale*, L.

### TRITICUM, *Sp. Pl.* 1st ed. p. 85.

1. *T. æstivum*. Not in Herb.

2. *T. hybernum*. Not in Herb.

3. *T. turgidum*, L.! is ordinarily cultivated wheat, included in *T. vulgare*, Vill.

4. *T. Spelta*, L.! The specimen of this is marked 4, and is *Spelta*, but it is also marked by Linn. "*T. hybernum.*"

5. *T. monococcum*, L.!

6. *T. repens*, L.!

7. *T. caninum*, L.! A small specimen is present, but not marked. In the 2nd edition the plant is removed to *Elymus*.

*T. Polonicum*, L.! 2nd edition, p. 127.

*T. tenellum*, *l. c.* 127, is *Brachypodium Poa*, R. et Sch., with three nerves to the glumes.

*T. junceum*, L.! Am. Acad. iv. 266.

*T. maritimum*, 2nd edit. p. 128, is *Sclerochloa dichotoma*, Link. Another marked "*Poa maritima*" by Linn., "*T. loliacum*" by Sm., and "*Festuca maritima*, No. 69," is *Brachypodium Poa.*

*T. unilaterale*, Mant. 35. This is also marked "*Nardurus* 6" by Linn. and by Smith "*T. subulatum*" and "*T. Hispanicum.*" I believe them all to be forms of *T. tenellum* mentioned above.

*T. prostratum*, Linn. fil. Supp. 114, from Pallas, is also in the Herbarium.

### ORYZA, *Sp. Pl.* 1st ed. p. 333.

1. *O. sativa*, L.!

### ZEA, *Sp. Pl.* 1st ed. p. 971.

1. *Zea Mays*, L.! One male specimen and one female of the peculiar form called *Macleatum*; glumes much elongated.

### COIX, *Sp. Pl.* 1st ed. p. 972.

1. *C. Lachryma Jobi*, L.!

### TRIPSACUM. Not in 1st edit.; in 2nd edit., p. 1378.

*T. dactyloides*, L.! From the Upsal Garden.

### OLYRA. Not in 1st edit.; in 2nd edit., p. 1379, from Am. Acad. v. 408.

*O. latifolia*, Linn.

### ZIZANIA, *Sp. Pl.* 1st edit. p. 991.

1. *Z. aquatica*, L.! The plant so named is the small state which I believe Linnæus, in his Mant. p. 295, intended to indicate by *palustris*,

of which form there is also a specimen from Upsal Garden, marked "*palustris*" by Sm. *Z. aquatica* would then be Sloane's plant 110, t. 67; and the large species what is called "*Tuscanina*" in North America, of which there is a good specimen in the Herbarium marked, but not by Linn., *Z. effusa.*

2. *Z. palustris* is taken up from Rheede; but there is no specimen in the Herbarium.

### SPINIFEX, *Sp. Pl.* Not in 1st or 2nd edit.: first described in Mantissa, p. 300.

*S. squamosus*, L.! male and female specimens.

### PHARUS. Not in 1st edit.; 2nd edit., p. 1408.

*P. latifolius*, L.! Am. Acad. v. 409. From Jamaica.

### ANDROPOGON, *Sp. Pl.* 1st edit. p. 1045.

1. *A contortum*, described from India. Not in Herb.
2. *A. divaricatum*, L.! from Virginia, Gron. 135, is *Androp. ternatus*, Nees, which name must give precedence to Linnæus's.
3. *A. nutans*, L.! From Jamaica, and also Virginia, Kalm, marked "*Lagurus*, Clayton, 600."
4. *A. alopecuroides*, from North America, is *Erianthus saccharoides*, Mich.
5. *A. distachyon* is *Apocopis Wightii*, Nees ab Esenb. Smith has written "Ask Thunberg if this be Burser's plant?" I suppose this has misled others, and hence a very different plant from Linnæus's original specimen is now called *Androp. distachyus.*
6. *A. Schœnanthus*, L.! From India and Arabia. This is the plant generally called "*A. Martini*," Roxb., "*A. pachnodes*," Trin., and many other names. It is quite distinct from Wallich's *A. Schœnanthus.* Linnæus's specimen is remarkably well figured by Ventenat, Cels. t. 89.
7. *A. Virginicum*, L.! From America.
8. *A. bicorne*, L.! From Brazil and Jamaica.
9. *A. hirtum*, L.! From Sicily, Smyrna, and Lusitania.
10. *A. Nardus*, L.! Described in Fl. Zey. 45, as *Lagurus*, and the plant there described is to be found in Hermann's Herb. vol. ii. 66.
11. *A. Ischæmum* is not the plant generally considered *A. Ischæmum*, but is *Andropogon provincialis*, Lam., a plant that I have rarely seen.

12. *A. fasciculatum.* Contains two species. One is *Eleusine Indica,* Gærtn., and the other is *Pollinia ciliata,* Trin. The reference to Sloane, t. 69, p. 2, is incorrect, as that is *Paspalum fasciculatum.*

*A. caricosum,* L.! 2nd edit. Sp. Pl. p. 1480, is *Androp. serratus,* Retz, which name must give place to Linnæus's.

*A. Gryllus,* Am. Acad. iv. 332, from South Europe, is *Chrysopogon Gryllus,* Trin.

*A. insulare, l. c.* v. 412, is *Panicum leucophæum,* H.B.K.

*A. Ravennæ,* 2nd edit. p. 1481, is *Erianthus Ravennæ,* P. de B.

*A. muticum, l. c.* 1482, described from C. B. S., is not in Herb.

*A. polydactylon,* Am. Acad. v. 412, from Jamaica, is *Chloris polydactyla,* Sw.

*A. quadrivalvis,* Mant. 303, printed in the margin, by mistake, "*nutans,*" is *Anthistiria ciliata,* Retz.

*A. cymbarium,* L.! Mant. 303, is the beautiful species of *Cymbopogon* which Sprengel calls *C. elegans.* Sent by Koenig from Ind. or.

*A. prostratum,* Mant. 304, is *Anthistiria prostrata,* Willd.

*A. barbatum,* Mant. 302, described from India, is *Chloris barbata,* Sw.

*A. scabrum,* Linn. Herb.! from Koenig, is *Chamæraphis hordeacea,* R. Br.

A plant from Feuillée, is *Androp. Xanthoblepharis,* Trin. Icon.; and there is also another of *Schisachyrium brevifolium* from the same person.

## HOLCUS, *Sp. Pl.* 1st edit. p. 1047.

1. *H. Sorghum* is *Sorghum vulgare,* Pers.

2. *H. saccharatus* is not in Herb.

3. *H. halepensis,* from Upsal Garden, is *Sorghum halepense,* Pers., awned and unawned.

4. *H. lanatus,* L.!

5. *H. odoratus.* One specimen is *Hierochloë borealis,* R. et Sch.; the other is *Hier. australis.*

6. *H. laxus,* from Virginia, is *Uniola gracilis,* Michx.

7. *H. striatus,* Gron. Virg. 135, is *Panicum gibbum,* Elliot.

*H. spicatus,* Sp. Pl. ed. 2. p. 1483, is *Penicillaria spicata,* Willd. This is also marked "*Alopecurus Indicus*" by Sm.

*H. mollis,* L.! 2nd edit. p. 1485.

*H. latifolius, l. c.* 1486, from Asia, Osbeck, is *Centotheca lappacea,* Desv. This is also marked "*Cenchrus lappaceus* and *Bambu Ramp.*"

*H. bicolor,* Mant. 301, from Persia, is a form of *Sorghum vulgare.* Pers.

*H. pertusus,* Mant. 301, is *Andropogon pertusus,* Willd.

*H. serratus,* Linn. Herb., is *Panicum serratum,* R. Br.

## APLUDA, *Sp. Pl.* 1st edit. p. 82.

There is much confusion about this genus. The species which appears in 1st edition is first described in 2nd edition Gen. Pl. (1742) as No. 1018, *Ischæmum,* from Scheuchz., and this is the plant described in 5th edition of Gen. Pl. (1754). The plant described in the 6th edition is *Zeugites* in the 8th edition, Schreber's (1789): it is the first *Apluda;* and hence I suppose P. de B. has called ordinary *Apluda, Calamina.*

1. *A. mutica,* L.!

*A. aristata,* L.! Am. Acad. iv. 303. This is also to be found in Herb. Pluk. i. 188. On one page there is a plant of *Anthistiria prostrata,* Willd.

*A. Zeugites,* Am. Acad. (1759) v. 412, figured by Browne as *Zeugites* (in 1755), is *Zeugites Americana,* Willd.

*A. digitata,* Linn. fil. Supp. 434, is *Polytoca bracteata.* Bennett in Pl. Jav. rar.

## MANISURIS. Not in 1st or 2nd edit. *Sp. Pl.* Just appears in Mantissa, 300.

*M. Myurus,* L.! Marked by Koenig "*Ægilops sanguinea,*" and by Linnæus as "*Ischæmum Myurus.*" Is sometimes called *Peltophorus Myurus,* Nees.

## ISCHÆMUM, *Sp. Pl.* 1st edit. p. 1049.

1. *I. muticum,* L.!
2. *I. aristatum,* L.! is what is generally called *I. barbatum.* One specimen is *Spodiopogon obliquivalvis,* Nees.

There is one spicula of *I. rugosum,* marked "*Cicadaria,*" from Koenig; and by Smith, "*Ischæmum rugosum,* Salisbury Ic. t. 1."

*Ischæmum murinum* from Forst., not in Linnæus's handwriting, is *Spodiopogon aureus,* Hook. et Arn. in Bot. of Beechey's Voyage.

There is also a single specimen of *Erianthus aureus,* P. de B., without name or locality; and a plant marked "*Isch. aculeatum,*" which is *Ceytosis aculeata,* Willd.

### CENCHRUS, 1st edit. *Sp. Pl.* p. 1049.

1. *C. racemosus* is *Lappago racemosa*, Willd.
2. *C. capitatus* is *Echinaria capitata*, Desf.
3. *C. echinatus*, L.! with rather a long spike.
4. *C. tribuloides*, L.! Sent by Kalm from Virginia.
5. *C. frutescens*. Not in Herb.

*C. lappaceus*, 2nd edit. p. 1488, is not in Herb., and the word is erased by Linnæus in a MS. note.

*C. muricatus*, Mant. 302. from Koenig, is *Trachys mucronata*, Pers. This is also named "*C. tripsaceus*" and "*Tripsacum distachyon*."

*C. ciliaris*, Mant. 302. One from Upsal Garden, and one from C. B. S.; are both *Pennisetum cenchroides*, Richd.

*C. granularis*, Mant. 575, is *Manisuris granularis*, Sw.

### ÆGILOPS, *Sp. Pl.* 1st edit. p. 1050.

1. *Æ. ovata*, L.!
2. *Æ. caudata*, L.!
3. *Æ. squarrosa*. Not in Herb.
4. *Æ. triuncialis*, L.!
5. *Æ. incurvata* is *Lepturus incurvatus*, Trin.

*Æ. exaltata*, Mant. 575, from Koenig, is *Ophiurus corymbosus*, Gærtn.

ROTTBŒLLIA is a genus of Linn. fil., first published in 'Nova Graminum Genera' (1779). The Herbarium contains

*R. incurvata*, which is *Lepturus incurvatus*;

*R. compressa*, Linn. fil. Suppl. 114, which is *Hæmarthria compressa*, R. Br.;

*R. dimidiata*, Linn. fil. Suppl. 114, which is *Stenotaphrum Americanum*, Schrank;

*R. exaltata*, Linn. fil.! *l. c.* 114.; and

*R. corymbosa*, Linn. fil. *l. c.* 114, which is *Ophiurus corymbosus*, Gærtn.

## Notes on *Caryophylleæ*, *Portulaceæ*, and some allied Orders.

By GEORGE BENTHAM, Esq., Pres. L.S.

[Read June 6, 1861.]

THE series of orders in which natural affinities are the most dissevered by the Candollean arrangement is undoubtedly that of the Curvembryonous group, of which each one appears to be connected with the others by gradations so close that positive limits have very seldom been assigned to any of them, and yet they are necessarily dispersed in the three great classes of Thalamifloræ, Calycifloræ, and Monochlamydæ. Thus we find in the 'Prodromus' that the numerous genera constituting the group are distributed among ten orders:—Caryophylleæ, referred to Thalamifloræ; Paronychiaceæ, Portulaceæ, and Ficoideæ, to Calycifloræ; and Phytolaccaceæ, Salsolaceæ (Chenopodieæ), Basellaceæ, Amarantaceæ, Polygonaceæ and Nyctagineæ, to Monochlamydæ. In this arrangement De Candolle appears to have been sometimes guided by the characters shown in what had been considered as the *typical* genus of each order. But the so-called typical genus of an order, as I believe I have already had occasion to point out to the Society, has not been always the one exemplifying in the most striking degree the characters prevailing in the majority of its co-ordinates, but, on the contrary, has often been remarkably exceptional, having been selected to give its name to the order from being the earliest or the most familiarly known to European botanists. Thus in Portulaceæ, for instance, the supposed typical genus *Portulaca*, having a semi-inferior ovary, determined the position of the order among Calycifloræ. It is, however, in that respect a remarkable exception in the order, all the rest of which (as it is usually limited) is essentially hypogynous. Some Caryophylleous genera are also more perigynous than several of those included by De Candolle in the supposed perigynous order Paronychiaceæ.

To remedy these and similar incongruities, several transpositions have been suggested by those who adhere generally to the Candollean classes. Thus, Asa Gray reduces Paronychiaceæ to a suborder of Caryophylleæ, and removes also Portulaceæ next to them among Thalamifloræ. Harvey and Sonder bring Phytolaccaceæ also up to Thalamifloræ, but leave Portulaceæ and Ficoideæ in Calycifloræ. Lindley rejecting the distinction between Apetalæ and Polypetalæ, has two hypogynous alliances—*Silenales*, consisting of Caryophyllaceæ, Illecebraceæ, Portulaceæ and Polygonaceæ, and *Chenopodales*, consisting of Nyctaginaceæ, Phytolaccaceæ, Amarantaceæ and Chenopodiaceæ; and one perigynous alliance, *Ficoidales*, composed of Basellaceæ, Mesembryaceæ, Tetragoniaceæ and Scleranthaceæ. Endlicher, on the other hand, rejecting the character derived from staminal insertion, but maintaining that founded on the presence or absence of petals, places Mesembryaceæ, Portulaceæ, Caryophyllaceæ and Phytolaccaceæ in one cohors among his Dialypetalæ, and Chenopodiaceæ, Amarantaceæ, Polygoneæ and Nyctaginaceæ in another cohors far away among Apetalæ. All, however, are ready to suggest that in a really natural system all the above orders ought to be brought together, which cannot be done without entirely rejecting the above-mentioned great Candollean classes; yet no substitute has been proposed for these classes, except a vain endeavour so to modify the linear series as to bring allied orders into close approximation. Thus Grisebach, one of the most able advocates for this arrangement (which, with any one for whose views we had less respect, we should be tempted to call a disarrangement), brings indeed all our Curvembryonous orders together, but places them between Euphorbiaceæ and Malvaceæ, which in our view have quite as much right to be placed in close proximity as Caryophylleæ and Chenopodieæ *.

In considering how to deal with these various proposals, we must observe that none of the classes, groups, or alliances so formed are limited by any character that does not undergo many exceptions among the genera placed under them; nor are we able to devise any other that shall be thus strictly and absolutely defined. Even the curvature of the embryo round a farinaceous albumen, the chief character of the whole group, can scarcely be traced in *Dianthus*, in some *Polycarpææ*, in *Anacampseros* and its allies, in some *Polygoneæ*, &c.; and the position of the leaves, the presence or absence of stipules and petals, the number and insertion of the stamens, the relative position of sepals, petals, stamens and carpels, the degree of combination or reduction of the carpels and ovules, are characters so variously combined or dissevered, as always to leave small anomalous genera invalidating or uniting any groups we can form. Our object has therefore been to seek out such limitations as may bring together genera having the greatest general resemblance, and united by such tangible characters as should have the fewest exceptions.

Our first great group is that of the CARYOPHYLLEÆ, the normal characters of which (besides those common to all the above orders) are opposite leaves; sepals, petals, and one or usually two series of stamens, all isomerous; a free one-celled ovary with several ovules in the centre, and formed by the combination of two or more carpels; and a dehiscent or several-seeded fruit. The opposition of the leaves has no exception; the sepals are never reduced, nor the petals increased in number, although the latter are often very much reduced in size, and in a few species totally deficient; the stamens of either series are never increased in number, but occasionally irregularly reduced, or one or the other series deficient; the ovary, if ever divided into cells, is only so at the very base or at a very early stage; the carpels are always closely combined, and in some genera the styles also; both are often reduced in number below that of the other parts of the flower, but never increased, and never reduced to one simple one; and there is only one species where the ovules are reduced to a single one. In the great majority of species the petals and stamens are hypogynous, and if, in a few others, the disk which bears them is perigynous, it is only slightly so; and we therefore concur with other botanists in placing the order among Thalamifloræ. We estimate the total number of good species of Caryophylleæ at about 800, and we distribute them into three tribes: 1. SILENEÆ, with a gamosepalous calyx and free styles; in these the stamens are always hypogynous, and there are no stipules; 2. ALSINEÆ, with free sepals and free styles; in them the stamens are hypogynous or slightly perigynous, and scarious stipules are present only in about half-a-dozen species (*Spergula* and *Spergularia*); and 3. POLYCARPÆÆ, with free sepals and combined styles. The stamens are, as in Alsineæ, hypogynous or slightly perigynous, and the stipules are most frequently, or perhaps always, present.

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* When in this and other similar papers I make use of the plural *we*, with reference to any general views on the principles of distribution and limitation of genera, I refer to those of Dr. Hooker and myself as adopted for the 'Genera Plantarum' we are preparing.

Our next order is that of the PORTULACEÆ, which, with the ovary of Caryophylleæ, is at once distinguished by the remarkable anisomery of the parts of the flower. The sepals are usually 2 only, with petals varying from 3 to 7 or 8; in one species only (*Lewisia*) the sepals are 5 or 6, with 8 to 10 petals. In no case are the petals deficient. The stamens are most frequently more numerous than the petals, and where equal to them in number, or fewer (sometimes only one), they are always opposite to them and adhering to their base. It was this remarkable divergence from the ordinary arrangement of the stamina in the group of orders we are considering, that induced Fenzl to extend the Portulaceæ so as to include all genera where a tendency to a similar arrangement may have been traced or supposed. But whilst we do full justice to the accuracy of Dr. Fenzl's observations on the whole of the curvembryonous orders which he has investigated with so much detail, we cannot concur in the general views he has taken of their delimitation, which, indeed, have not met with general adoption. The disturbance of the ordinary alternation in the different whorls composing the flower is curious in several Caryophylleæ, without our being able to detect any cause or to trace any connexion with other characters: thus the styles are opposite the sepals in *Cerastium*, alternate with them in *Sagina*, and when exceptionally pentagynous, as in *S. aquatica*, in *Stellaria*. The stamens, when reduced to 5, are usually opposite the sepals, but alternate with them in *Colobanthus*, without however being epipetalous or accompanied by any other of the characters of Portulaceæ; and, again, in *Schiedea*, so nearly allied in most respects to *Stellaria*, and having both series of stamens present in their usual position, the petals are opposite the sepals, which does not occur in any other genus of the Curvembryonous group. It has been endeavoured to explain this circumstance by calling the petals staminodia or sterile filaments; but that does not remove the difficulty; for when staminodia do exist in any allied order, they are not, any more than petals, placed as in *Schiedea*.

The Portulaceæ, as we should continue to limit them, have been generally recognized as a natural group. They are more or less succulent. The leaves are alternate or occasionally opposite, but never perhaps so strictly so as in Caryophylleæ; the petals either very fugacious or shrinking very soon into a withered mass, which makes it very difficult in some of the minute-flowered species to ascertain their number or shape from dried specimens. All genera, except *Portulaca* itself, are essentially hypogynous; and in *Portulaca*, where the ovary is half-inferior, the ring bearing the petals and stamens is as closely connected with the ovary as with the calyx; so that if, as has been suggested, the adherent base of the flower be considered as an enlarged concave torus or summit of the pedicel, the insertion of the petals in *Portulaca* may be said to be less truly perigynous than in those Alsineæ where they proceed from a disk lining the base of the calyx and free from the ovary. We therefore have no hesitation in following A. Gray and others, who rank Portulaceæ among Thalamifloræ. The ovary in *Portulacaria* is uniovulate, and becomes an indehiscent 3-winged nest; and in *Silvæa* the fruit is a 1-seeded utricle; but in both genera the flowers are too decidedly Portulaceous to remove them from the family.

The Tetragonieæ and Sesuvieæ, united by Fenzl with Portulaceæ, differ both from them and from Caryophylleæ in their ovary divided into cells, and in their very perigynous stamens.

We would propose to restore them to FICOIDEÆ, where they were placed by De Candolle and others, and from which they chiefly differ in the absence of petals. As they belong most decidedly to Calycifloræ, which we have not as yet worked up in detail, I shall defer for the present any further observations on the genera they consist of.

The MOLLUGINEÆ, also included by Fenzl among Portulaceæ, have been referred by some to Paronychiaceæ on account of their stipules, by others to Caryophylleæ for their capsular fruit. They form a small group, however, which cannot well be attached to either of the allied larger orders without in some measure invalidating their characters. From Caryophylleæ they differ in their alternate stem-leaves (often apparently verticillate, but never really so, nor yet opposite, although the bracts may be so in a few cases), and in their septate ovary and capsule; from Portulaceæ in their isomerous calyx, septate ovary, usual want of petals, and habit; from Ficoideæ in habit and in their stamens usually hypogynous or nearly so; from Phytolaccaceæ, Paronychiaceæ, and other Monochlamydeous orders in the several-seeded cells of their ovary and fruit. They are all apetalous, except *Macarthuria*, *Telephium*, and occasionally *Glinus*, and do not well come in either with Thalamifloræ or Calycifloræ. We think they might be best placed amongst Monochlamydæ next to Phytolaccaceæ, or even incorporated in that order as a tribe, bearing in some measure a relation to the true Phytolaccaceæ similar to that which Celosieæ do to the remaining Amarantaceæ.

The PARONYCHIACEÆ form the link which unites Caryophylleæ with Amarantaceæ. They were formerly distinguished from Caryophylleæ by the supposed constantly perigynous insertion of the stamens; but this character proving in many instances fallacious, it has been proposed to take the presence of stipules as the ordinal distinction. That, again, separated *Spergula* and *Spergularia* from the closely allied Alsineæ; and Fenzl, A. Gray, and others unite the whole with Caryophylleæ. It appears to me, however, that if we limit Paronychiaceæ to the genera with a uniovulate (although compound) ovary and utricular fruit, we have a distinct group, more nearly allied to Amarantaceæ than to Caryophylleæ, and which, as all except *Corrigiola* are decidedly apetalous, would take its place among Monochlamydæ.

With regard to PHYTOLACCACEÆ, characterized by the ovary consisting of one or usually several annular uniovulate carpels, and to CHENOPODIACEÆ and AMARANTACEÆ, with their vague but universally recognized ordinal distinctions, we leave them for the present as elaborately worked up in the 'Prodromus,' entering only our provisional protest against the useless change in name from Chenopodiaceæ to Salsolaceæ, against the separation of Basellaceæ as an order, against the importance attached to the erect or horizontal seeds, and against much superfluous splitting both of genera and of species upon inconstant characters.

The four orders, either retained among Thalamifloræ or now first transferred to Monochlamydæ, call however for some observations as to the limits of genera which I shall now severally enumerate.

## I. CARYOPHYLLEÆ.

The limits of most of the large genera of this order have always been very artificial, and were made to rest by Linnæus chiefly on the number of parts of the flower. As these have been shown to be in some cases very variable, and often quite unconnected with habit or other characters, A. Braun, Fenzl, and others have resorted to the embryo, the venation of the calyx, the dehiscence of the capsule, &c.; and the latter character has been especially relied upon by Fenzl, who has alone investigated specifically the whole order, and worked out a large portion of it with the greatest accuracy of detail. He has not, indeed, been always successful in the new combinations he has formed to replace the old Linnean genera; his distinction between *Arenaria* and *Alsine*, for instance, is not a natural one; but, on the other hand, he has much improved the circumscription of some genera, such as *Gypsophila*, *Cerastium*, &c., and contributed very largely to our accurate knowledge of the various forms assumed by the numerous species, races, and varieties of the order. In determining the limits to be assigned to our genera, we have always found we could place implicit reliance on the characters assigned by him to the species he examined, as well as on those given by A. Braun, J. Gay, and M. Willkomm, who have specially studied portions of the order.

Of the three above-mentioned tribes of Caryophylleæ, the first, SILENEÆ, has been universally recognized as distinctly marked out by the gamosepalous calyx, and has even been raised by many modern botanists to the rank of an independent order. We continue it as a tribe only, and we still think that the large genera of the older botanists, with some slight modifications founded on the capsule, the embryo, or on the venation of the calyx, are as natural as any that have been subsequently proposed. We purpose adopting the following eleven.

* *Semina peltata, hilo faciali. Embryo rectus.*

1. *Velezia*, Linn. 2. *Dianthus*, Linn. 3. *Tunica*, Scop.

** *Hilum marginale. Embryo periphericus.*

4. *Acanthophyllum*, C. A. Mey. 5. *Drypis*, Linn. 6. *Gypsophila*, Linn.
7. *Saponaria*, Linn. 8. *Silene*, Linn. 9. *Cucubalus*, Linn. (ex parte).
10. *Lychnis*, Linn. 11. *Wibelinia*, Hochst.

*Dianthus* is the most natural and best-defined genus of the whole order. The calyx is peculiar, never angular, but marked by numerous equal parallel ribs—7, 9, or 11 to each sepal, or 35, 45, or 55 in the whole, and is always surrounded at the base by one or more pairs of bracts. Ten stamens, two styles, a capsule opening at the top by 4 teeth or short valves, and seeds much flattened, attached by their inner face, with a straight embryo, complete the distinctive characters, to which we believe there are no exceptions. The species are numerous, but have been enormously multiplied in books, being particularly liable to variation in their bracts, in their showy petals, in the density of the inflorescence, &c. They are moreover said to hybridize in a wild state with the greatest facility; but this is a point which requires much further unprejudiced observation.

*Tunica* is a group of about 10 species which have been variously distributed in *Dianthus* and *Gypsophila*, or separated into one, two, or three genera. They have the seeds, and in most cases the bracts, of *Dianthus*; but the calyx has either only 5 nerves, as in *Gypsophila*, or at most 2 lateral ones to each sepal, or 15 in the whole. Most of the species, on account of their short calyx and small bracts, were included by Linnæus in *Gypsophila*; one species, however (now often broken up into three), with a long calyx completely enveloped in scarious bracts, was included by him in *Dianthus* (*D. prolifer*, L.), and constitutes the genus *Kohlrauschia* of Kunth. As a solitary species we think it more convenient to retain it in *Tunica*, as there are no very positive characters to separate it. Again, in Fenzl's section *Pseudotunica*, raised by Reichenbach to the rank of a genus under the name of *Fiedlera*, there are no outer bracts, but all the other characters are those of the true *Tunicas*.

*Velezia*, very near *Tunica* in technical characters, may nevertheless be maintained as an old-established genus, to which the very slender calyx and rigid habit give a peculiar aspect. The

Linnean character of 5 instead of 10 stamens is said not to be quite constant; but I have always found 5 only in the few specimens I have examined.

*Acanthophyllum* and *Drypis*, with a general affinity to *Saponaria*, are closely connected with each other in their prickly foliage, bracts and calyx-teeth, in their ovary and fruit. The ovules are few; and of these few, seldom more than one attains maturity. The capsule has been described as circumsciss, but in most cases that dehiscence has appeared to me to have arisen from the manner in which the specimens had been dried. In many Sileneæ the upper portion of the capsule assumes a more cartilaginous and stiffer consistence than the lower part; in these two genera it is particularly thick, and opens in valves only very late or not at all, whilst the lower portion, especially if gathered before it is quite ripe, remains thin and herbaceous, so as to break from it with very little force, but I have never seen the upper portion fall off naturally. The characters by which the two genera are distinguished are more artificial. *Acanthophyllum*, containing about a dozen species, has a 5-angled or 5-ribbed calyx, either without any lateral nerves, or one faint one to each sepal, on each side of the midrib; the stamens are usually 10, and the styles 2. In *Drypis*, still limited to the old Linnean species, the calyx has many ribs, with those of adjoining sepals usually free from each other as in Diantheæ, not united as in *Silene* and *Lychnis*; the stamens are usually 5, and the styles 3, although I have not unfrequently observed 2 or 5 styles. *Jordania* of Boissier appears to have the general characters of *Acanthophyllum*, without sufficient difference in habit to maintain it as a distinct genus on account of the capsule more readily splitting into 4 valves.

*Gypsophila* and *Saponaria*, again, are too closely blended with each other to suffer any positive line of distinction to be drawn between them, a few of the smaller-flowered species being almost equally referable to the one or to the other; yet, as old-established and rather numerous groups with a great majority of well-characterized species, they may still be maintained as separate genera. With the seeds, the 10 stamens, and other general characters of *Silene* and *Lychnis*, they are readily known by the calyx, in which the lateral nerves of adjoining sepals, if present, never amalgamate, and by the styles, which are almost if not quite always two only. They differ from each other chiefly in the calyx, which in *Gypsophila* is usually turbinate or campanulate, not contracted at the top, with 5 usually broad nerves, and is more or less membranous and veinless between them, whilst in *Saponaria* it is tubular or pyramidal or slightly contracted at the top, and, in most cases, even the midrib of each sepal is scarcely conspicuous. In *Gypsophila*, moreover, the capsule opens much more deeply into 4 valves than in *Saponaria*, which has usually only 4 short teeth.

Among the small genera proposed by various authors which we do not consider sufficiently distinct to adopt, *Banffya*, Baumg., and *Dichoglottis*, Fisch. and Mey., are chiefly distinguished by inflorescence; *Heterochroa*, Bunge (*Acosmia*, Benth. in Wall. Cat.), by the more deeply cleft calyx; and *Ankyropetalum*, Fenzl, by the rigid habit and small narrow calyx, which bring it very near to the small-flowered *Saponarias*. *Vaccaria*, Medik., a single wide-spread cornfield weed, appears to have been better placed by Linnæus in *Saponaria*, than by more modern botanists in *Gypsophila*.

The two large genera *Silene* and *Lychnis* are distinguished from all the preceding ones, except the single species of *Drypis*, by the styles, which are universally (except perhaps in very rare anomalous flowers) more than two, and by the calyx, which, in all but the very few conical *Silenes*, has ten more or less prominent nerves, the two lateral ones of adjoining sepals being constantly blended into one. But the limits between the two genera are less natural and less accurately defined. The Linnean character of 3 styles in *Silene*, and 5 or rarely 4 in *Lychnis*, although not quite constant, is perhaps even now the best that has been proposed, and the very few species where these numbers are slightly variable must be referred to that genus with which the great majority of their flowers agree.

With regard to their subdivision, many natural groups have been formed, which, especially in the case of *Lychnis*, have been frequently raised to the rank of genera. But the most marked are generally single species; and others, if tolerably defined in one genus, have their corresponding forms in the other, passing gradually into different groups. We therefore cannot at present see any course more in conformity to our general principle than to qualify the greater number of them as more or less artificial sections only of two artificial but large genera. I shall proceed to enumerate the most important.

*Cucubalus*, intended by Linnæus to include a number of *Silenes* with very inflated calyces, but since restricted to the *S. baccifer*, in which the fruit, although not exactly a berry, has the appearance of one, and does not open in valves, may still be conveniently retained as a genus; for that very decided and exceptional character is accompanied by considerable differences in the general aspect as well of the flower as of the whole plant.

*Heliosperma*, Reichb., proposed for a few small white-flowered *Silenes* with very muricate seeds, and *Elisanthe*, Fenzl, adopted by Willkomm for the species with laciniate petals, usually red, though both well marked in a very few cases, are too closely connected through others with the great mass of the genus to form more than sections, and even as such are not so good as *Conoimorpha*, for instance, and *Behenanthe*.

*Melandrium*, Roehl., has about a dozen species of *Lychnis*, chiefly northern or alpine, with inflated calyxes, and the teeth or valves of the capsule splitting into two so as to become double in number to the styles. But the calyx in some species passes gradually into that of *Lychnis* proper, and the splitting of the capsule-teeth in others is exceedingly slight, and we cannot attach much importance to it in this any more than in other Caryophylleous genera.

*Viscaria*, Roehl., was originally proposed for a few species in which the ovary is shortly divided at the base into 5 cells—a slight rudimentary indication of the typical formation of the gynæcium, of little more importance here than in the few *Silenes* and *Dianthuses* in which it occurs. Two of the four *Viscarias* have been again separated under the name of *Eudianthe*, as having the capsular teeth split. These formed part of *Agrostemma*, Linn., characterized by the long narrow calyx-teeth. The latter name has now been restricted to a single species only differing from *Lychnis* proper by those calyx-teeth and by the stiffness of the scales at the base of the petals; and another *Agrostemma* of Linnæus has been erected into the genus *Githago*, as having the styles alternating with, not opposite the sepals—a circumstance very difficult to ascertain with certainty in the gamosepalous genera, especially in the dried state, and which, if correct, may be due to a slight torsion of the torus.

*Petrocoptis*, A. Braun, comprising two Pyrenæan species, has a more definite character in the expansion of the funiculus into a small strophiola; but the habit is not very marked, and there is no other character. The æstivation of the petals is indeed said not to be contorted as in other Caryophylleæ, but it certainly is so occasionally, and a few other species of *Lychnis* have been observed where the contorted arrangement is sometimes broken. I have also myself seen it so not unfrequently in *Stellaria holostea*, and it probably occurs in other instances.

*Uebelinia*, Hochst., a single Abyssinian species, may, however, have sufficient claims to be admitted as a genus. Besides the reduction of the stamens to 5, the shape of the calyx, the habit, and inflorescence are very different from those of *Lychnis*, reminding one of *Gypsophila cerastioides*. The calyx has 10 ribs, and the styles are 5 as in *Lychnis*.

The numerous species of the tribe ALSINEÆ have always been found very difficult to divide into natural genera with definite characters. For those without stipules more than thirty have been proposed, of which, however, we think it most convenient to adopt the following eleven only: 1. *Holosteum*, Linn.; 2. *Cerastium*, Linn.; 3. *Stellaria*, Linn.; 4. *Brachystemma*, Don; 5. *Arenaria*, Linn.; 6. *Buffonia*, Linn.; 7. *Sagina*, Linn.; 8. *Colobanthus*, Bartl.; 9. *Thylacospermum*, Fenzl; 10. *Schiedea*, Cham. et Schlecht.; and 11. *Queria*, Linn.; and to these we add the two stipulate genera—12. *Spergula*, Linn., and 13. *Spergularia*, Pers. Of these genera the four principal ones were supposed to have been well defined by the earlier botanists—*Cerastium* by 5 styles and bifid petals, *Stellaria* by 3 styles and bifid petals, *Arenaria* by 3 styles and entire petals, *Sagina* by 4 styles and entire petals. But in each case species have been since observed where these characters have not proved constant, or where their strict adoption has occasioned severances too purely artificial to be maintained, and others have been successively called in aid.

In *Cerastium*, the form of the capsule (its elongated apex always shortly and regularly divided into twice as many teeth as styles) appears not only the best corroborative character, but even to take precedence over those derived from the divided petals and number of styles, as being more in conformity with general habit. We would thus, with Fenzl, bring into *Cerastium* the *Stellaria cerastioides*, Linn., and *S. viscida*, Bieb., although they have the 3 styles of *Stellaria*, as well as the small genus *Mœnchia*, in which the petals are entire or notched only and the flowers isomerous throughout as in *Sagina*, although the styles are opposite the sepals as in *Cerastium*. The two species referred to *Mœnchia*, the one with 4-merous, the other with 5-merous flowers, were therefore formerly placed, the first in *Sagina*, the other in *Cerastium*, but it is now generally believed that they are mere varieties of one species. Again, the *Arenaria purpurascens*, Ram., a Pyrenæan plant with much of the habit of *Cerastium trigynum* (*Stellaria cerastioides*), but with the petals and styles of *Arenaria*, and proposed as a distinct genus under the name of *Dufourea*, might, on account of the capsule, be better referred to *Cerastium*, where Fenzl once placed it.

*Holosteum* is a small genus, most elaborately described by J. Gay, and reducible, as he proposes, to two or even to a single species. It has the capsule of *Cerastium*, but may be maintained as distinct on account of the habit and inflorescence and the peculiar seed. This is flattened from front to back as in *Dianthus* and its allies, but the radicle, instead of being short and straight as in those genera, is turned down in a projection of the inner face by which the seed is attached, thus combining the two forms of embryo which prevail in Caryophylleæ.

*Stellaria* is a large and widely spread genus, tolerably natural, and, as to the large majority of species, well marked by the three styles, bifid petals, and the capsule divided to about the middle into as many entire or bifid valves. But there are a few anomalous species, mostly isolated or nearly so, which have been separated into distinct genera upon real or fancied discrepancies, which however we think ought, from the general concordance of characters, to be retained in *Stellaria*. These are—

1. *Larbrea*, A. de St. Hil., founded on *S. uliginosa*, which has the petals and stamens more distinctly perigynous than in most other species, though still very slightly so ; but this is a question of degree only, as a more or less distinct perigyny may be observed in several other species where the petals are much reduced.

2. *Malachium*, Fries, has been generally adopted for the *S. aquatica*, placed by Linnæus in *Cerastium* as having 5 styles. It differs, however, from that genus in the styles being alternate with, not opposite to, the sepals. The habit, petals, &c., are those of *Stellaria nemorum*; the capsule only differs in the valves being rather less deeply bifid; and the number of styles is, in Indian specimens, not unfrequently reduced to three as in other *Stellarias*.

3. *Krascheninikowia*, Turcz., was adopted by Fenzl as distinguished by the petals emarginate only or shortly bifid, although the original Siberian *K. rupestris* is apparently identical with the Carpathian *Stellaria bulbifera*, and very nearly allied to some other eastern or South-European species. The genus has, however, since been remodelled by Maximowicz and made to rest on dimorphous flowers, the apparently perfect ones in the East-Asiatic specimens being usually sterile, whilst the seeds are produced by small, almost apetalous oligandrous flowers near the base of the stem. But this, although, as far as I am aware, the first

case of dimorphism observed in the flowers of Caryophylleæ, has now been ascertained to exist in so many different Polypetalous orders, and to be so frequently not even of specific value, that we cannot admit it as a generic character when unaccompanied by any other.

4. *Leucostemma*, Benth., was a genus I originally proposed for two Himalayan species with tetramerous flowers, at a time when the number of parts was still considered as of absolute value in the generic distinction of Caryophylleæ; but Fenzl has since very properly reduced them to *Stellaria*, of which they have all the other characters.

5. *Adenonema*, Bunge, containing a few high alpine Asiatic and South-American species, differs from *Stellaria* as *Cherleria* from *Arenaria*, by its short densely tufted stems, the excessively reduced petals, and more developed glands of the disk; and the same arguments which have induced many botanists to reduce *Cherleria* to *Arenaria* (or *Alsine*) would equally apply to the reunion of *Adenonema* with *Stellaria*, especially as the passage from the one to the other is gradual.

6. *Schizotechium*, Fenzl, although only proposed as a section of *Stellaria*, might have perhaps rather more claims than any of the preceding to be adopted as a genus. It consists of two Himalayan species with a scandent habit and diffuse panicles, almost as in *Brachystemma*, and only 3 ovules, of which but one ripens. The ovary might thus be supposed to be reduced to uniovulate carpels, and to be brought technically nearer to that of Phytolaccaceæ; but there is no central axis, and a slight comparison of actual specimens will at once give the idea that it is an exceptional and irregular reduction in the ovules of a closely compound ovary, and not a normal conformity of the ovules with as many distinct or well-marked carpels. The foliage, inflorescence, and flowers are in all other respects those of *Stellaria*, in which genus we continue to retain *Schizotechium* as a section.

*Brachystemma*, Don, to which we have just alluded as resembling *Schizotechium* in habit, is a single Himalayan species with the entire petals of *Arenaria*. The stamens, of which 5 only bear anthers, the 2 styles, 4 ovules, and usually one-seeded capsule, may also be found occasionally in that genus; but all these features being united and accompanied by a different habit, a large scarious calyx with minute petals may warrant us in retaining it as a distinct genus.

We now come to the great genus *Arenaria*, whose limits are the most puzzling to define among the whole range of Caryophylleæ. Originally characterized by 5 sepals, 5 entire petals, 10 or rarely 5 stamens, and 3 styles, it was subsequently found that these numbers were liable to variation, that in some species the petals were excessively reduced or disappeared altogether, in others the styles were frequently reduced to 2, and that characters derived from number could no longer exclude the Linnean genera *Cherleria, Minuartia, Mœhringia,* &c., whilst on the other hand the capsule appeared to afford means of dividing the whole group in a more definite manner. Accordingly the greater number of species have been distributed into three principal genera, *Arenaria, Mœhringia,* and *Alsine* ; and at least ten others have been proposed, chiefly for individual species in which some striking peculiarity has been observed. But a further consideration of the results has convinced us that the three large groups are far too unnatural to be considered as more than artificial sections; and that the prominent characters of the monotypic genera differ but in degree from those exemplified in other species. *Spergularia* alone forms an exception, and is generally admitted; for although the presence of stipules is its only positive character, its affinity is evidently much more with *Spergula* than with *Arenaria.*

*Arenaria* itself is limited by Fenzl and others to those species in which the capsular valves are more or less deeply divided so as to become double the number of the styles, and the seeds are without any strophiola; *Mœhringia* has a similar capsule, but the seeds are smooth and shining, with the funicle expanded into a strophiola; and *Alsine* has the capsular valves entire, of the same number as the styles. These characters are tolerably definite, and not liable to much variation in the same species, and therefore excellent for sectional distinction. But when it is considered that *A. Ledebouriana, A. Roylei,* and their allies are in *Arenaria,* whilst *A. laricifolia, A. pinifolia,* &c., are in *Alsine,*—that *A. pubescens, A. hispida,* and *A. diffusa,* Ell. (*A. nemorosa,* H. B. et K.), go together in *Arenaria,* whilst *A. trinervis, A. bavarica,* and *A. lateriflora* are in *Mœhringia,*—that *A. polygonoides* is in *Mœhringia* and *A. procumbens* in *Alsine* (or in *Rhodalsine* of Gay),—that *A. modesta, A. conimbricensis,* &c., are retained in *Arenaria,* whilst all their nearest allies belong to *Alsine,* and that the alpine cæspitose species are also distributed between the two, these sections can scarcely be considered as better genera than the old Linnean one.

The characters upon which the smaller, mostly monotypic genera *Cherleria, Siebera, Minuartia, Dolophragma, Triplateia, Gouf-*

*feia*, *Lepyrodiclis*, *Odontostemma*, *Honckeneya*, and *Merckia* have been founded are chiefly,—unisexuality, absence of petals, a great development of the glands of the disk, the division of the ovary into 3 cells, the complete separation of the capsular valves to the base, or a reduction in the number of stamens, styles, or ovules.

Unisexuality, or rather polygamy, has been much relied on for the genus *Honckeneya*, made for the *A. peploides*. But although in Europe and Asia the plant is certainly most frequently unisexual, yet in America it is generally, and according to A. Gray universally, hermaphrodite, without there being any other distinction between the two races.

The absence of petals induced Linnæus to separate *Cherleria* and *Minuartia*; but this absence has been since shown not to be constant, and other species closely allied to the one or to the other in habit have very minute petals, which again, through other species, pass into those of more conspicuous size; and accordingly Fenzl and others have already united these two genera with *Alsine*.

The glands of the disk are more or less developed in many *Arenarias*, but are only taken as generic characters as being specially prominent in *Cherleria* and in *Honckeneya*, two species which have nothing else to connect them but what is common to the whole genus *Arenaria*.

The division of the ovary into three cells is relied upon for *Dolophragma*, *Honckeneya*, and *Merckia*; and if it were constant and persistent, and only to be seen in the two latter, it might be made use of to separate them, as they have also in common a larger, almost succulent globular capsule, and some affinity in habit. But the dissepiments are only to be found at a very early stage; they are always very thin and slender, and have generally disappeared by the time the flower has expanded, and I at least have never found any remains of them when the capsule is ripe. This division into cells can therefore only be regarded as rudimentary; it may be traced here and there throughout Caryophylleæ, and, as in other cases of undeveloped rudimentary organs, no further systematic value can be attributed to it than as an indication of the normal type, of which the Caryophyllaceous ovary is a modification.

The valves of the capsule separate to the base and spread out horizontally in *Triplateia*. But the depth to which the capsule splits is very variable in the whole genus; and, in the single *Triplateia* known, there is nothing marked in habit to distinguish it from some *Mœhringias*, whilst any other exceptional characters which it possesses are also to be found in species which have not the same capsule or habit.

The stamens are reduced to 5 in *Triplateia*, in a few *Alsines*, and occasionally in other species which have little else in common with them.

The styles and, consequently, the carpels are reduced to 2, and the ovules to 4, with a depressed globular capsule, in *Gouffeia*, *Lepyrodiclis*, and *Odontostemma*, and this brings these four species (*Lepyrodiclis* having two) technically as near to *Buffonia* as to *Arenaria*; but their habit is so dissimilar from each other (except that of *Odontostemma* to one species of *Lepyrodiclis*), and that of two of them so near to that of two corresponding species of *Arenaria* proper, that they can only form a very artificial group, which we prefer to consider as a section of *Arenaria*, where a similar but less constant reduction of carpels or of ovules occurs in other very dissimilar species.

It might be said that where two or three of these exceptional characters are combined, such as the split capsule and reduced ovules and stamens in *Triplateia*, or unisexuality, large glands, and rudimentary dissepiments in *Honckeneya*, they might warrant generic separation; and so it would be if any such plant had these characters exclusively, or if they were similarly combined in several species having some general features in common; but as neither is the case in any of the above instances, we can only consider the plants so isolated as exceptional species, not as separate groups.

To the numerous small genera above enumerated as separated from *Arenaria* on insufficient grounds, we may add the following nine proposed or adopted by Reichenbach on still more trifling characters: *Sabulina*, *Tryphane*, *Facchinia*, *Alsinanthe*, *Neumayera*, *Wierzbeckia*, *Plinthine*, *Pettera*, and *Eremogone*.

With regard to *Buffonia*, it is with much hesitation that we have retained it as a small distinct genus; for the distinctive characters are very slight; and although the four (5 or 6 ?) species which compose it have much resemblance in habit, they also come very near to some of the small-flowered fine-leaved *Arenarias*.

*Sagina* was formerly a purely artificial genus, comprising all the tetramerous Alsineæ; but as some of these have been shown to be mere varieties of pentamerous species placed in *Cerastium* or in *Spergula*, the genus has been remodelled by Fenzl, so as to exclude *S. erecta* and to include those *Spergulas* of Linnæus which have no stipules. It has thus become much more natural, and although still very nearly allied to some of the smaller *Arenarias*, it is well characterized by the styles, whether 4 or 5, always isomerous with the sepals, and alternating with, not opposite to them as in *Cerastium*, and as in the old *Sagina* (or *Mœnchia*) *erecta*, now transferred to *Cerastium*, of which it has also the capsule. The pentamerous *Saginas* have been proposed by some German authors as a distinct genus under the name of *Spergella*; but the character is purely artificial, and not always constant in the same species.

The four remaining small genera of exstipulate Alsineæ have each some remarkable peculiarity of structure which has occasionally suggested their respective removal to some other order, but their general affinities are clearly with Alsineæ, and I have already alluded to the insufficiency of these peculiarities for their removal. Thus, *Colobanthus* has no petals, and the stamens, of the same number as the sepals, are alternate with, not opposite to them; but the remaining characters and habit are those of *Sagina*: *Thylacospermum* only differs from the low tufted alpine Cherlerioid *Arenarias* by the calyx forming an obconical tube at the base, round the margin of which are inserted the stamens, which are thus, exceptionally, very perigynous: *Schiedea*, with the habit and most of the characters of some *Stellarias*, is distinguished by the remarkable position of the petals (or staminodia?) opposite the petals, already alluded to: and *Queria*, very near some of the smaller annual *Arenarias*, has only one ovule and no petals, and thus passes into Paronychiaceæ; but as the fruit is a three-valved capsule and not a utriculus, I have preferred retaining it among Alsineæ.

The stipulate Alsineæ comprise two genera of three or four species each—*Spergula*, Linn., and *Spergularia*, Pers. (*Lepigonė*, Fries)—differing by their stipules only, the first from *Sagina*, the second from *Arenaria*. This character, admitted as ordinal by some botanists who transfer these genera to Paronychiaceæ, is rejected by others even as generic, as being derived from vegetative organs alone. Estimating its value from its practical relation to habit, we are induced in this instance to consider it as generic, placing *Spergula* and *Spergularia* in the tribe of Alsineæ, of which they have the free styles, rather than with the other stipulate Caryophylleæ which form our tribe of Polycarpeæ.

*Balardia*, Cambess., is a South-American *Spergularia* with reduced petals and stamens, and has been correctly referred to that genus by Fenzl and others.

The Caryophylleæ of our third tribe, POLYCARPEÆ, with free sepals and the styles more or less united, are almost all stipulate.

They comprise the eleven following genera :—1. *Drymaria*, Willd.; 2. *Polycarpon*, Linn.; 3. *Ortegia*, Linn.; 4. *Lœflingia*, Linn.; 5. *Cerdia*, Moç. et Sess.; 6. *Pycnophyllum*, Remy; 7. *Lyallia*, Hook. fil.; 8. *Microphyes*, Philippi; 9. *Stipulicida*, Rich.; 10. *Polycarpæa*, Lam.; and 11. *Sphærocoma*, Anders. Very few of these require any special observations.

*Arversia*, Cambess., or *Hapalosia*, W. et Arn., ought in our opinion to be reduced to *Polycarpon*. The embryo is indeed straighter in *Arversia* (*Hapalosia*) *Lœflingii* than is usual in *Polycarpon*, but it is very variable in the undoubted species of the latter genus, and I have in vain searched for the spiral twist in the valves of the capsule supposed to characterize the typical *P. tetraphyllum*.

*Stichophyllum*, Philippi, figured in his 'Flora of Atacames,' proves, on examination of his specimens, to be identical with one species of *Pycnophyllum*, Remy. The same plant in Meyen's collection received from Presl the manuscript name of *Xeria Meyeniana*, and is, according to Walpers, the *Arenaria bryoides*, Willd.

*Lyallia*, Hook. fil., is but very imperfectly known, and is only placed here from its close resemblance in habit to *Pycnophyllum*.

*Cerdia*, Moç. et Sess., is only known from DeCandolle's characters taken from Moçino and Sesse's drawing.

*Polycarpæa*, Lam. (proposed by Webb to be spelt *Polycarpia*, but perhaps without sufficient grounds for disturbing the established orthography), is now a large genus divisible into several groups, some of them distinguished by habit without characters, and others which have more definite characters have so precisely the aspect of the typical *Polycarpæas* that we cannot adopt them as separate genera. I allude especially to the two supposed Australian genera, *Aylmeria*, Mart., and *Planchonia*, J. Gay. The former closely resembles the common *P. corymbosa*, but the flowers are rather larger and more scarious, and there are 5 minute staminodia alternating with the stamens at the base of the petals. In *Planchonia*, of which we have five or six species, the flowers are often still larger and more scarious; there are no staminodia; but the petals and stamens are united, sometimes above the middle into a long tube, sometimes at the base only into a shorter cup. Yet striking as the character is in some species, it is one of degree only, and a slight union may be observed in some other non-Australian species.

*Sphærocoma*, T. Anders., like *Queria*, is intermediate between Caryophylleæ and Paronychiaceæ. The fruit is an indehiscent utriculus as in the latter order; but the presence of petals, and the two ovules with the funicles united in a central columella, show more affinity with Caryophylleæ.

## II. PORTULACEÆ.

This Order, once more reduced by most botanists to its abovementioned original and natural limits, consists at present of about 125 species distributed into the following 14 genera:—1. *Portulaca*, Linn.; 2. *Portulacaria*, Jacq.; 3. *Grahamia*, Gill.; 4. *Talinopsis*, A. Gray; 5. *Anacampseros*, Linn.; 6. *Talinum*, Adans.; 7. *Calandrinia*, H. B. et K.; 8. *Claytonia*, Linn.; 9. *Spraguea*, Torr.; 10. *Monocosmia*, Fenzl; 11. *Montia*, Linn.; 12. *Silvæa*, Philippi; 13. *Calyptridium*, Nutt.; and 14. *Lewisia*, Pursh.

Of the above genera, *Portulaca*, comprising a considerable number of species, and *Portulacaria* and *Lewisia*, each of a single species, are too well marked by the exceptional characters already alluded to (p. 58) to admit of any doubt. *Grahamia* from Chili and *Talinopsis* from New Mexico, both monotypic, and *Anacampseros* from South Africa, consisting of about eight species, are closely connected by their nearly straight or slightly curved (not annular) embryo with very little albumen, and by some general resemblances in their flowers; yet, as slight differences in the calyx and bracts accompany considerable diversity in habit and a wide geographical separation, they may be maintained as distinct genera, unless the discovery of intermediate species should hereafter connect them more closely.

*Talinum*, *Calandrinia*, and *Claytonia* are also very closely allied to each other, being only separated by the sepals, deciduous in *Talinum*, persistent in the two others, or by the stamens, constantly 5 (one opposite each petal) in *Claytonia*, anisomerous with the petals and usually more numerous in *Talinum* and *Calandrinia*. These characters are moreover not quite constant; yet, as each group comprises a considerable number of species bearing other general resemblances to each other, we feel that it would not be safe to recommend their union into one genus without a more detailed examination of every species than can be undertaken on the present occasion.

*Spraguea*, a single Californian species, is nearly allied to *Claytonia*; but the remarkable calyx gives it so peculiar an aspect, that we do not venture to reduce it.

*Montia*, also monotypic, is, however, very distinctly characterized by its stamens (usually 3) inserted in the tube of a gamopetalous corolla.

The three remaining genera—*Silvæa*, said to consist of four species (of which I have only seen and examined one), and *Monocosmia* and *Calyptridium*, both monotypic—agree in their very small monandrous flowers; but evident differences in their inflorescence and sepals, and alleged ones in their corollas, which, on account of their extreme tenuity and rapid fading, I am unable to verify with certainty in dried specimens, have induced me to maintain them as distinct.

*Baitaria*, Ruiz et Pav., is one of the dwarf alpine species of *Calandrinia*, of which the bracts have been described as outer sepals. *Diazia*, Philippi, described and figured from a single very imperfect specimen, is probably also a species of *Calandrinia* with the stamens very much reduced in number. At any rate, should it hereafter prove distinct, the name must be altered, as too closely resembling *Diasia*, an Irideous genus.

*Fouquiera*, H. B. et K. (including *Bronnia*, H. B. et K.), connected by some authors with Portulaceæ, by others with Polemoniaceæ, is perhaps more nearly related to some of the Calycifloroug groups connected with Saxifragaceæ, which we reserve for future consideration.

## III. MOLLUGINEÆ.

This small group, whether considered as a tribe of Phytolaccaceæ or as an allied order, ought, in our opinion, to be limited to the following seven genera:—1. *Macarthuria*, Endl.; 2. *Telephium*, Linn.; 3. *Orygia*, Forsk. (*Axonotechium*, Fenzl); 4. ? *Glinus*, Linn.; 5. *Mollugo*, Linn.; 6. *Pharnaceum*, Linn. (*Ginginsia*, DC.; *Hyperteles*, E. Mey.); 7. *Cœlanthium*, E. Mey. In the four first genera petals are occasionally, or, in two or three species, always present; the three others, forming the great proportion of the tribe or order, are always apetalous. The total number of species is, however, not above 40.

*Macarthuria* was originally referred to the vicinity of Buettneriaceæ, but upon what grounds it is very difficult to imagine; the very imbricate sepals, the insertion of the stamens, the habit, &c., being so totally at variance with all the Malvoid orders. Harvey first pointed out (Kew Journ. Bot. vii. 55) its affinity with Phytolaccaceæ, and F. Müller has, I believe (although I am unable now to find a reference to his note), referred it to Mollugineæ. One species has always petals, another is quite apetalous; the ovary, styles, capsule, and seeds are quite those of Mollugineæ. The stamens appear to be always 8 in an otherwise pentamerous flower; but this want of symmetry between the number of stamens and that of the petals or sepals is very common in the whole group.

*Telephium* is exceptional among Mollugineæ, in that the ovary is divided into cells at the base only, but the dissepiments, short as they are, are firm and persistent; the sepals, petals, and stamens are isomerous, and the stamens are opposite the sepals, as in several Caryophylleæ; but the alternate leaves, the inflorescence, the consistence of the sepals, and other characters are those of Mollugineæ, and a very cursory comparison with *Orygia* shows a very intimate connexion of the two genera.

*Orygia* (a single species, dispersed over the hot dry regions of Africa and Asia) has indefinite stamens surrounded by narrow-linear petals, very variable in number or occasionally entirely wanting, and which are by some termed staminodia or barren stamens. In this respect the genus approaches *Glinus*, whilst the foliage, habit, and inflorescence are very nearly those of *Telephium*, under which genus it has sometimes been classed.

*Glinus* forms so gradually the passage from *Orygia* to *Mollugo*, that it is hard to assign to it precise limits; the common species has usually indefinite stamens (between 10 and 20) as in *Orygia*, but clustered axillary flowers as in several *Mollugos*, whilst the woolly indumentum and the large calyxes give it a very different aspect from the latter genus. A second species (or, according to some, a small-flowered variety only) has the reduced stamens of *Mollugo*, but the aspect of *Glinus*; and the *Mollugo spergula* of Linnæus, with the small glabrous flowers and few stamens of *Mollugo*, is considered by Fenzl as a third species of *Glinus*, of which it has the strophiolate seeds. The inflorescence is rather that of *M. verticillata* (which has no strophiola to the seeds) than of *Glinus*. This gradual connexion might suggest the propriety of considering *Glinus* altogether as a section only of *Mollugo*, which, after all, would only contain about a dozen species.

*Pharnaceum* is a Cape genus of about eighteen species, distinguished from *Mollugo* chiefly by fimbriate stipules and a peculiar habit. Several of the species have also a cupular hypogynous disk within the stamens, but this is not constant even in all the species considered as true *Pharnacea*. A small section, *Hyperteles*, E. Mey., retained by Harvey and Sonder as a distinct genus, has no disk and indefinite stamens; an increase, however, in the number of stamens beyond 5 occurs in some species considered as true *Pharnacea*, and the habit of the two sections is the same.

*Cœlanthium*, limited to two Cape species, differs from *Pharnaceum* as *Thylacospermum* from *Arenaria*, by the union of the sepals at the base into a campanulate tube, round the edge of which are inserted the stamens, being thus much more decidedly perigynous than in the rest of the group.

The genera *Psammotrophe*, Eckl. & Zeyh., and *Polpoda*, Presl, with uniovulate cells to the ovary, enumerated by Fenzl among Mollugineæ, appear to have nothing to distinguish them from true Phytolaccaceæ. *Adenogramma*, Presl, is also a Phytolaccaceous plant allied to *Giesekia*, where the ovary and fruit are reduced to a single one-seeded carpel, not compounded of 2 or 3 carpels although one-seeded as in Paronychiaceæ. *Acrossanthes*, on the other hand, both in habit and character, belongs to the apetalous Ficoideæ.

## IV. PARONYCHIACEÆ.

Without having sufficiently examined all the genera of this Order to ascertain their limits with respect to each other, or the order of their arrangement, we have, however, verified the ordinal characters in all the following (except *Cardionema*):—

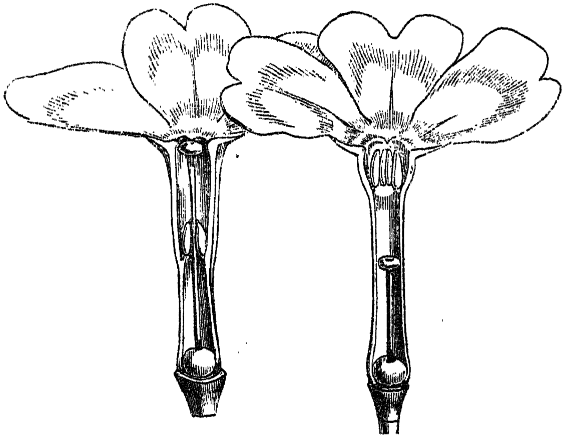
1. *Corrigiola*, Linn. (an exceptional genus in its prominent petals and alternate leaves); 2. *Herniaria*, Linn.; 3. *Illecebrum*, Linn.; 4. *Cardionema*, DC.; 5. *Pentacæna*, Bartl.; 6. *Paronychia*, Juss. (including *Siphonychia*, Torr. et Gray, and *Anychia*, Rich., and perhaps altogether, with *Cardionema* and *Pentacæna*, artificial sections of *Illecebrum*); 7. *Habrosia*, Fenzl; 8. *Sclerocephalus*, Boiss.; 9. *Gymnocarpos*, Forsk.; 10. *Pteranthus*, Forsk.; 11. *Cometes*, Burm.; 12. *Dicheranthus*, Webb; 13. *Pollichia*, Soland.; 14. *Guilleminea*, H. B. et K.; 15. *Mniarum*, Forst.; 16. *Scleranthus*, Linn.; and 17. *Lastarriea*, A. Gay.

## On the Two Forms, or Dimorphic Condition, in the Species of *Primula*, and on their remarkable Sexual Relations. By CHARLES DARWIN, M.A., F.R.S., F.L.S., &c.

[Read Nov. 21, 1861.]

IF a large number of Primroses or Cowslips (*P. vulgaris* and *veris*) be gathered, they will be found to consist, in about equal numbers, of two forms, obviously differing in the length of their pistils and stamens. Florists who cultivate the Polyanthus and Auricula are well aware of this difference, and call those which display the globular stigma at the mouth of the corolla "pin-headed" or "pin-eyed," and those which display the stamens "thumb-eyed." I will designate the two forms as long-styled and short-styled. Those botanists with whom I have spoken on the subject have looked at the case as one of mere variability, which is far from the truth.

In the Cowslip, in the long-styled form, the stigma projects just above the tube of the corolla, and is externally visible; it stands high above the anthers, which are situated halfway down the tube, and cannot be easily seen. In the short-styled form the anthers are attached at the mouth of the tube, and therefore stand high above the stigma; for the pistil is short, not rising above halfway up the tubular corolla. The corolla itself is of a different shape in the two forms, the throat or expanded portion above the attachment of the anthers being much longer in the long-styled than in the short-styled form. Village children notice this difference, as they can best make necklaces by threading and slipping the corollas of the long-styled flowers into each other. But there are much more important differences. The stigma in the long-styled plants is globular, in the short-styled it is depressed on the summit, so that the longitudinal axis of the former is sometimes nearly double that of the latter. The shape, however, is in some degree variable; but one difference is persistent, namely, that the stigma of the long-styled is much rougher: in some specimens carefully compared, the papillæ which render the stigmas rough were in the long-styled form from twice to thrice as long as in the short-styled. There is another and more remarkable difference, namely, in the size of the pollen-grains. I measured with the micrometer many



Long-styled. Short-styled.

specimens, dry and wet, taken from plants growing in different situations, and always found a palpable difference. The measurement is best made with grains distended with water, in which case, the usual size of the grains from short-styled flowers is seen to be $\frac{10-11}{7000}$ of an inch in diameter, and those from the long-styled about $\frac{7}{7000}$ of an inch, which is in the proportion of three to two; so that the pollen-grains from the short stamens are plainly smaller than those from the long stamens which accompany the short pistil. When examined dry, the smaller grains from the long-styled plants are seen under a low power to be more transparent than the larger grains, and apparently in a greater degree than can be accounted for by their less diameter. There is also a difference in shape, the grains from the short-styled plants being nearly spherical, those from the long-styled being oblong with the angles rounded; this difference in shape disappears when the grains are distended with water. Lastly, as we shall presently see, the short-styled plants produce more seed than the long-styled.

To sum up the differences:—The long-styled plants have a much longer pistil, with a globular and much rougher stigma, standing high above the anthers. The stamens are short; the grains of pollen smaller and oblong in shape. The upper half of the tube of the corolla is more expanded. The number of seeds produced is smaller.

The short-styled plants have a short pistil, half the length of the tube of the corolla, with a smooth depressed stigma standing beneath the anthers. The stamens are long; the grains of pollen are spherical and larger. The tube of the corolla is of the same diameter till close to its upper end. The number of seeds produced is larger.

I have examined a large number of flowers; and though the shape of the stigma and the length of the pistil vary, especially in the short-styled form, I have never seen any transitional grades between the two forms. There is never the slightest doubt under which form to class a plant. I have never seen the two forms on the same plant. I marked many Cowslips and Primroses, and found, the following year, that all retained the same character, as did some in my garden which flowered out of their proper season in the autumn. Mr. W. Wooler, of Darlington, however, informs us that he has seen the early blossoms on Polyanthuses which were not long-styled, but which later in the season produced flowers of this form. Possibly the pistils may not in these cases have become fully developed during the early spring. An excellent proof of the permanence of the two forms is seen in nursery gardens, where choice varieties of the Polyanthus are propagated by division; and I found whole beds of several varieties, each consisting exclusively of the one or the other form. The two forms exist in the wild state in about equal numbers: I collected from several different stations, taking every plant which grew on each spot, 522 umbels; 241 were long-styled, and 281 short-styled. No difference in tint or size could be perceived in the two great masses of flowers.

I examined many cultivated Cowslips (*P. veris*) or Polyanthuses, and Oxlips; and the two forms always presented the same differences, including the same relative difference in the size of the pollen-grains.

*Primula Auricula* presents the two forms; but amongst the improved fancy kinds the long-styled are rare, as these are less valued by florists, and seldomer distributed. There is a much greater relative inequality in the length of the pistils and stamens than in the Cowslip, the pistil in the long-styled form being nearly four times as long as in the short-styled, in which it is barely longer than the ovarium; the stigma is nearly of the same shape in both forms, but it is rougher in the long-styled, though the difference is not so great as in the two forms of the Cowslip. In the long-styled plants the stamens are very short, rising but little above the ovarium. The pollen-grains of these short stamens from the long-styled plants, when distended with water, were barely $\frac{5}{6000}$ of an inch in diameter, whereas those from the long stamens of the short-styled plants were barely $\frac{7}{6000}$, showing a relative difference of five to seven. The smaller grains of the long-styled plants were much more transparent, and before distention with water more triangular in outline than those of the other form. In one anomalous specimen with a long pistil, the stamens almost surrounded the stigma, so that they occupied the position proper to the stamens of the short-styled form; but the small size of the pollen-grains showed that these stamens had been abnormally developed in length, and that the anthers ought to have stood at the base of the corolla.

In the two forms of *Primula Sinensis*, the pistil is about twice as long in the one as in the other. The stigma of the long-styled varies much in shape, but is considerably more elongated and rougher than that of the short-styled, the latter being nearly smooth and spherical, but depressed on the summit. The shape of the throat of the corolla in the two forms differs as in the Cowslip, as does the length of the stamens. But it is remarkable that the pollen-grains of both forms, wet and dry, presented no difference in diameter; they vary somewhat in size, as do the pollen-grains of all the species, but in both forms the average diameter was rather above $\frac{10}{6000}$ of an inch. There is one remarkable difference in the two forms of this species, namely (as we shall presently more fully see), that the short-styled plants, if insects be excluded and there be no artificial fertilization, are quite sterile, whereas the long-styled produce a moderate quantity of seed. But when both forms are properly fertilized, the short-styled flowers (as with Cowslips) yield more seed than the long-styled. In a lot of seedlings which I raised, there were thirteen long-styled and seven short-styled plants.

Of *Primula ciliata* a long-styled specimen, and of *P. ciliata*, var. *purpurata*, a short-styled specimen, were sent me from Kew by Prof. Oliver. This case, however, is hardly worth giving, as the variety *purpurata* is said* to be a hybrid between this species and *P. auricula*; and the height of the stamens in the one form does not correspond with the height of the stigma in the other, as they would have done had they been the same species. There was, however, the usual difference in the roughness of the stigmas in the two forms, and the pollen-grains, distended in water, measured $\frac{6}{6000}$ and $\frac{4-5}{6000}$ of an inch in diameter. Single trusses were sent me of *P. denticulata* and *P. Piedmontana* which were long-styled, and of *P. marginata* and *nivalis* which were short-styled; and the general character of the organs leaves hardly any doubt on my mind that these species are dimorphic. In a single flower of *P. Sibirica*, however, which was sent me from Kew, the stigma reached up to the base of the anthers; so that this species is not dimorphic, or not dimorphic as far as the length of the pistil and stamens are concerned, unless indeed this single specimen was anomalous, like that mentioned of *P. auricula*.

We thus see that the existence of two forms is very general, if not universal, in the genus *Primula*. The simple fact of the pollen-grains differing in size and outline, and the stigma, in shape and roughness, in two sets of individuals of the same species, is curious. But what, it may be asked, is the meaning of these several differences? The question seems worthy of careful investigation, for, as far as I know, the use or meaning of dimorphism in plants has never been explained; hence, I will give my observations in detail, though I am far from supposing that all cases of dimorphism are alike. The first idea which naturally occurred was, that the species were tending towards a dioicous condition; that the long-styled plants, with their rougher stigmas, were more feminine in nature, and would produce more seed; that the short-styled plants, with their long stamens and larger pollen-grains, were more masculine in nature. Accordingly, in 1860, I marked some Cowslips of both forms growing in my garden, and others growing in an open field, and others in a shady wood, and gathered and weighed the seed. In each of these little lots the short-styled plants yielded, contrary to my expectation, most seed. Taking the lots together, the following is the result:—

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* Sweet's 'Flower Garden,' vol. v. tab. 123.

| | No. of Plants. | No. of Umbels produced. | No. of Capsules produced. | Weight of seed in grains. |
|---|---|---|---|---|
| Short-styled Cowslips | 9 | 33 | 199 | 83 |
| Long-styled Cowslips | 13 | 51 | 261 | 91 |

If we reduce these elements for comparison to similar terms, we have—

| | No. of Plants. | Weight of seed in grains. | No. of Umbels. | Weight of seed. | No. of Capsules. | Weight of seed in grains. |
|---|---|---|---|---|---|---|
| Short-styled Cowslips | 10 | 92 | 100 | 251 | 100 | 41 |
| Long-styled Cowslips | 10 | 70 | 100 | 178 | 100 | 34 |

So that, by all the standards of comparison, the short-styled are the most fertile; if we take the number of umbels (which is the fairest standard, for large and small plants are thus equalized), the short-styled plants produce more seed than the long-styled, in the proportion of four to three.

In 1861 I tried the result in a fuller and fairer manner. I transplanted in the previous autumn a number of wild plants into a large bed in my garden, treating them all alike; the result was—

| | No. of Plants. | No. of Umbels. | Weight of seed in grains. |
|---|---|---|---|
| Short-styled Cowslips ... | 47 | 173 | 745 |
| Long-styled Cowslips ... | 58 | 208 | 692 |

These figures, reduced as before, give the following proportions:—

| | Number of Plants. | Weight of seed in grains. | Number of Umbels. | Weight of seed in grains. |
|---|---|---|---|---|
| Short-styled Cowslips ... | 100 | 1585 | 100 | 430 |
| Long-styled Cowslips ... | 100 | 1093 | 100 | 332 |

The season was much better this year than the last, and the plants grew in good soil, instead of in a shady wood or struggling with other plants in the open field; consequently the actual produce of seed was considerably greater. Nevertheless we have the same relative result; for the short-styled plants produced more seed than the long-styled in the proportion of three to two; but if we take the fairest standard of comparison, namely, the number of umbels, the excess is, as in the former case, as four to three.

I marked also some Primroses, all growing together under the same conditions; and we here see the product:—

| | No. of Plants. | Total No. of Capsules. | Good Capsules. | Weight of seed in grains. | Or by Calculation : | Good Capsules. | Weight of seed. |
|---|---|---|---|---|---|---|---|
| Short-styled Primroses | 8 | 49 | 40 | 16 | | 100 | 40 |
| Long-styled Primroses | 9 | 68 | 50 | 10 | | 100 | 20 |

The number of Primrose plants tried was hardly sufficient, and the season was bad; but we here again see (excluding the capsules which contained no seed) the same result in a still more marked manner, for the short-styled plants were twice as productive of seed as the long-styled plants.

I had, of course, no means of ascertaining the relative fertility of the two forms of the Chinese Primrose in a natural condition, and the result of artificial fertilization can hardly be trusted; but sixteen capsules from long-styled flowers, properly fertilized, produce 9·3 grains' weight of seed, whereas eight capsules of short-styled flowers produced 6·1 grains; so that if the same number, namely, 16 of the latter, had been fertilized, the weight of seed would have been 12·2, which would have been nearly in the proportion of four to three, as in Cowslips.

Looking to the trials made during two successive years on the large number of Cowslips, and on these facts with regard to common Primroses and Chinese Primroses, we may safely conclude that the short-styled forms in these species are more productive than the long-styled forms; consequently the anticipation that the plants having largely developed pistils with rougher stigmas, and having shorter stamens with smaller pollen-grains, would prove to be more feminine in their nature is exactly the reverse of the truth. If the species of *Primula* are tending to become dioicous, which possibly may be the case, the future hypothetical females would have short pistils, and the males would have short stamens; but this tendency is accompanied, as we shall presently see, by other conditions of the generative system of a much more singular nature. Anyhow, the possibility of a plant thus becoming dioicous by slow degrees is worthy of notice, as the fact would so easily escape observation.

In 1860 I found that a few umbels of both long-styled and short-styled Cowslips, which were covered by a net, did not produce seed, though other umbels on the same plants, artificially fertilized, produced an abundance of seed; and this fact shows that the mere covering in itself was not injurious. Accordingly, in 1861 I covered up under a similar net several plants just before they opened their flowers; these turned out as follows:—

| | No. of Plants. | No. of Umbels produced, | Product of Seed. |
|---|---|---|---|
| Short-styled .............. | 6 | 24 | 1·3 grains, or 50 seeds. |
| Long-styled ...... ......... | 18 | 74 | Not one seed. |

Judging from the exposed plants which grew all round in the same bed, and had been treated in every way exactly the same, except that they were exposed to the visits of insects, the six short-styled plants ought to have produced 92 grains' weight of seed instead of only 1·3; and the eighteen long-styled plants, which produced not one seed, ought to have produced above 200 grains' weight. The production of the 1·3 grain of seed in the smaller lot was probably due to the action of Thrips or some minute insect. This evidence is sufficient, but I may add that ten pots of Polyanthuses and Cowslips of both forms, protected from insects in my greenhouse, did not set one pod, though artificially fertilized flowers in other pots produced an abundance. So we see that the visits of insects are absolutely necessary to the fertilization of Cowslips. As the exposed plants produced an abundance of seed, the tendency to a dioicous condition, previously remarked on, might have been safely carried on, as we see that there is an effective agency already at work which would have carried pollen from one sex to the other.

What insects habitually visit Cowslips, as is absolutely necessary for their regular fertility, I do not know. I have often watched them, but perhaps not long enough; and only four times I have seen Humble-bees visiting them. One of these bees was gathering pollen from short-styled flowers alone, another had bitten holes through the corolla; and neither of these would have been effective in the act of fertilization: two others were sucking long-styled plants. I have watched Primroses more attentively during several years, and have never seen an insect visit them; yet from their close similarity in all essential respects to Cowslips, there can hardly be a doubt that they require the visits of insects. Hence I am led to suppose that both Primroses and Cowslips are visited by moths. All the species which I have examined secrete plenty of nectar.

In *Primula Sinensis*, when protected from insects and not artificially fertilized, the case is somewhat, but not materially, different. Five short-styled plants produced up to a given period 116 flowers, which set only seven capsules, whereas twelve other flowers on the same plants artificially fertilized set ten capsules. Five long-styled plants produced 147 flowers, and set sixty-two capsules; so that this form, relatively to the other, sets a far greater number of capsules: yet the long-styled protected flowers do not set nearly so well as when artificially fertilized; for out of forty-four flowers thus treated, thirty-eight set. These remarks apply only to the early setting of the capsules, many of which did not continue swelling. With respect to the product of seed, seven protected short-styled plants, which bore about 160 flowers, produced only half a grain of seed; they ought to have produced 120 grains: so that the short-styled plants, when protected from insects, are nearly as sterile as Cowslips. Thirteen long-styled plants, which bore about 380 flowers, and which as we have seen set many more capsules, produced 25·9 grains of seed; they ought to have produced about 220 grains in weight: so that although far less fertile than the artificially fertilized flowers, yet the long-styled *P. Sinensis*, when protected from insects, is nearly twenty-four times as fertile as the short-styled when protected from insects. The cause of this difference is, that when the corolla of the long styled plants falls off, the short stamens near the bottom of the tube are necessarily dragged over the stigma and leave pollen on it, as I saw by hastening the fall of nearly withered flowers; whereas in the short-styled flowers, the stamens are seated at the mouth of the corolla, and in falling off do not brush over the lowly seated stigma. In the Cowslip the corolla does not fall off; and both long-styled and short-styled plants are equally sterile when protected from insects. It is a rather curious case, that the falling of the corolla, or its remaining attached when withered, might have a considerable influence on the numbers of a plant, during a year unfavourable to the visits of the proper insects.

In three short-styled plants of *Primula auricula*, protected from insects, the flowers which I fertilized produced seed, but those which were not touched produced none.

In all the species of *Primula* the pollen readily coheres to any object. In all that I have observed, though the stamens and pistils differ in length relatively to each other in the different species, yet, in the two forms of the same species, the stigma of the one form stands at exactly the same height with respect to the corolla as the anthers of the other form. If the proboscis of a dead Humble-bee, or thick bristle, or rough needle be pushed down the corolla, first of one form, and then of the other, as an insect would do in visiting the two mingled forms, it will be found that pollen from the long-stamened form will adhere round the base of the proboscis, and will be left with certainty on the stigma of the long-styled form; pollen from the short stamens of the long-styled form will also adhere a little above the tip of the proboscis, and some will generally be left on the stigma of the other form. Thus pollen will be carried reciprocally from one form to the other. In withdrawing the proboscis from the long-styled form, with pollen adhering near the tip, there will be a good chance of some being left on the flower's own stigma, in which case there will be self-fertilization; but this by no means always occurs. In the short-styled form, on the other hand (and it is important to remember this), in inserting the proboscis between the anthers situated at the mouth of the corolla, pollen, as I repeatedly found, is almost invariably carried down and left on the flower's own stigma. Moreover minute insects, such as Thrips, numbers of which I have observed in Primrose flowers thickly dusted with pollen, could not fail often to cause self-fertilization. We positively know that the visits of large insects are necessary to the fertilization of the species of *Primula*; and we may infer from the facts just given that these visits would carry pollen reciprocally from one form to the other, and would likewise *tend* to cause self-fertilization, more especially in the short-styled (*i. e.* long-stamened) form.

These observations led me to test the potency of the two pollens with respect to the two stigmas in *P. veris*, *Sinensis*, and *auricula*. In each species four crosses can be tried; namely, the stigma of the long-styled by its own-form pollen and by that of the short-styled, and the stigma of the short-styled by its own-form pollen and by that of the other form. It is necessary to use and remember two new terms for these crosses: when the long- and the short-styled stigmas are fertilized by their own-form pollen the union is said to be "homomorphic;" when the long-styled and short-styled stigmas are fertilized by the pollen of the other form, the union is "heteromorphic." I speak of the "own-form pollen," because in the following homomorphic unions, in order to make the experiment perfectly fair, I never placed the pollen of the same flower on its own stigma, but, to avoid the possible ill effects of close interbreeding, I always used the pollen from another plant of the same form. In the following experiments all the plants were treated in exactly the same manner, and were carefully protected from insects as far as that is possible. I performed every manipulation myself, and weighed the seed in a chemical balance. Some of the capsules contained no seed, or only two or three, and these are excluded in the column marked "good pods." First for *P. Sinensis*, as the simplest case.

*Primula Sinensis.*—Table I.

|  | Number of flowers fertilized. | Total number of pods produced. | Number of good pods. | Weight of seed in grains. | By Calculation. Good Pods. { Weight of seed in grains. |
|---|---|---|---|---|---|
| Long-styled by own-form pollen (homomorphic union) .... | 20 | 18 | 13 | 5·9 | or as 100 to 45 |
| Long-styled by pollen of short-styled (heteromorphic union)... | 24 | 18 | 16 | 9·3 | or as 100 to 58 |
| Short-styled by own-form pollen (homomorphic union)..... | 7 | 5 | 4 | 0·9 | or as 100 to 22 |
| Short-styled by pollen of long-styled (heteromorphic union)... | 8 | 8 | 8 | 6·1 | or as 100 to 76 |
| Summary : |  |  |  |  |  |
| The two homomorphic unions ................ | 27 | 23 | 17 | 6·8 |  |
| The two heteromorphic unions .. ............. | 32 | 26 | 24 | 15·4 |  |

For the sake of comparison, we may reduce these latter figures as follows:—

| | Number of flowers fertilized. | Number of good pods. | Weight of seed in grains. | Number of good pods. | Weight of seed in grains. |
|---|---|---|---|---|---|
| The two homomorphic unions .................. | 100 | 63 | 25 | 100 | 40 |
| The two heteromorphic unions .......... | 100 | 75 | 48 | 100 | 64 |

In the first part of the upper table, the number of flowers fertilized and the simple result is shown; and at the right hand, for the sake of comparison, the calculated product of the weight of seed from 100 good pods of each of the four unions is given; showing that in each case the heteromorphic union is more fertile than the homomorphic union. Beneath we have a simple summary of the two homomorphic and the two heteromorphic unions. And lastly, for the sake of comparison, a calculation has been made from this summary; first, assuming that 100 flowers of both kinds of unions were fertilized; and then to the right hand, assuming that 100 good pods were produced from both unions. If we compare the result, we see that the flowers of the two heteromorphic unions produced a greater number of good pods, and a greater weight of seed, than the flowers of the two homomorphic unions; and again (and this is the fairest element of comparison, for accidents are thus almost eliminated), that the good pods from the two heteromorphic unions yielded more seed, in about the proportion of three to two, than those from the two homomorphic unions. The difference in weight from 100 capsules of the two forms is 24 grains, and this is equal to at least 1200 seeds.

Beneath we have Table II. of *P. veris*, or the Cowslip. The upper part is exactly the same as in the Table of *P. Sinensis*, and we see in each case that the heteromorphic is more fertile than the homomorphic union. The calculated results from the summary of the two homomorphic and the two heteromorphic unions are more complex than with the last species, as I wished to show that, however we proceed, the general result is the same. We see that the assumed hundred flowers, heteromorphically fertilized by the pollen of the other forms, yielded more capsules, more good capsules, and a greater weight of seed; but I rely little on this, as some whole umbels perished after being fertilized. The fairest element of comparison is to take the good capsules alone; and we here see that the 100 from the two heteromorphic unions yielded seed which in weight was as 54 to 35 from the 100 good capsules of the two homomorphic unions,—that is, nearly as three to two, as in the Chinese Primrose.

*Primula veris.*—TABLE II.

| | Number of flowers fertilized. | Total number of pods produced. | Number of good pods. | Weight of seed in grains. | By Calculation. Good Pods. { Weight of seed in grains. |
|---|---|---|---|---|---|
| Long-styled by own-form pollen (homomorphic union) .... | 20 | 8 | 5 | 2·1 | or as 100 to 42 |
| Long-styled by pollen of short-styled (heteromorphic union)... | 22 | 15 | 14 | 8·8 | or as 100 to 62 |
| Short-styled by own-form pollen (homomorphic union) ..... | 15 | 8 | 6 | 1·8 | or as 100 to 30 |
| Short-styled by pollen of long-styled (heteromorphic union)... | 13 | 12 | 11 | 4·9 | or as 100 to 44 |
| Summary : | | | | | |
| The two homomorphic unions ................ | 35 | 16 | 11 | 3·9 | |
| The two heteromorphic unions ................ | 35 | 27 | 25 | 13·7 | |

For the sake of comparison, we may reduce these figures as follows:—

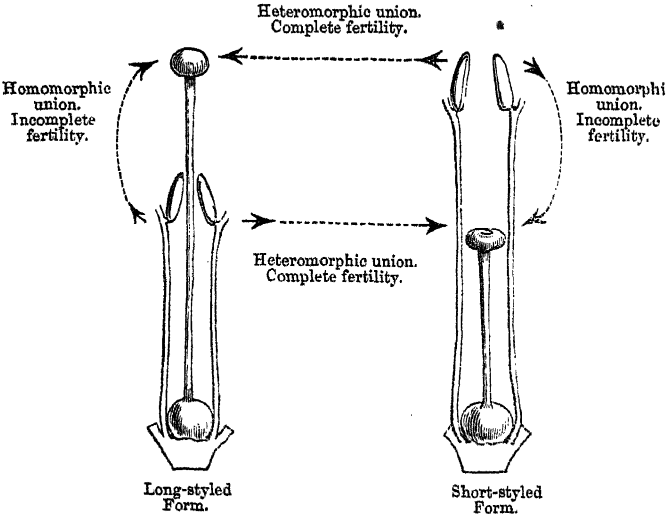
| | Number of flowers fertilized. | Total number of pods produced. | Number of good pods. | Weight of seed in grains. | Total number of pods produced. | Weight of seed in grains. | Number of good pods. | Weight of seed in grains. |
|---|---|---|---|---|---|---|---|---|
| The two homomorphic unions ..... | 100 | 45 | 31 | 11 | 100 | 24 | 100 | 35 |
| The two heteromorphic unions ..... | 100 | 77 | 71 | 39 | 100 | 50 | 100 | 54 |

With *P. auricula* I was unfortunate; my few seedlings, except one poor plant, all came up short-styled; and of these plants several died or became sick, owing to the hot weather and the difficulty of excluding insects and ventilating the corner of my greenhouse enclosed with net. I finally got only two pods from one union, and three from the other. The result is given in the following table; and, though worth little, we here again see that the heteromorphic are far more fertile than the homomorphic unions.

*Primula auricula.*—TABLE III.

| | Total number of pods produced. | Number of good pods. | Weight of seed in grains | Good Pods. Weight of seed in grains. |
|---|---|---|---|---|
| Short-styled by own-form pollen (homomorphic union) .. | 2 | 1 | 0·12 | or as 100 to 12 |
| Short-styled by pollen of long-styled (heteromorphic union) | 3 | 3 | 1·50 | or as 100 to 50 |

Whoever will study these three tables, which give the result of 134 flowers carefully fertilized and protected, will, I think, be convinced that in these three species of *Primula* the so-called heteromorphic unions are more fertile than the homomorphic unions. For the sake of clearness, the general result is given in the following diagram, in which the dotted lines with arrows represent how in the four unions pollen has been applied.



We here have a case new, as far as I know, in the animal and vegetable kingdoms. We see the species of *Primula* divided into two sets or bodies, which cannot be called distinct sexes, for both are hermaphrodites; yet they are to a certain extent sexually distinct, for they require for perfect fertility reciprocal union. They might perhaps be called sub-dioicous hermaphrodites. As quadrupeds are divided into two nearly equal bodies of different sexes, so here we have two bodies, approximately equal in number, differing in their sexual powers and related to each other like males and females. There are many hermaphrodite animals which cannot fertilize themselves, but must unite with another hermaphrodite: so it is with numerous plants; for the pollen is often mature and shed, or is mechanically protruded, before the flower's own stigma is ready; so that these hermaphrodite flowers absolutely require for their sexual union the presence of another hermaphrodite. But in *Primula* there is this wide difference, that one individual Cowslip, for instance, though it can with mechanical aid imperfectly fertilize itself, for full fertility must unite with another individual; but it cannot unite with any individual in the same manner as an hermaphrodite Snail or Earth-worm can unite with any other one Snail or Earth-worm; but one form of the Cowslip, to be perfectly fertile, must unite with one of the other form, just as a male quadruped must and can unite only with a female.

I have spoken of the heteromorphic union in *Primula* as resulting in full fertility; and I am fully justified, for the Cowslips thus fertilized actually gave rather more seed than the truly wild plants —a result which may be attributed to their good treatment and having grown separately. With respect to the lessened fertility of the homomorphic unions, we shall appreciate its degree best by the following facts. Gärtner has estimated the degree of sterility of the union of several distinct species*, in a manner which allows of the strictest comparison with the result of the heteromorphic and homomorphic unions of *Primula*. With *P. veris*, for every hundred seeds yielded by the heteromorphic unions, only sixty-four seeds were yielded by an equal number of good capsules from the homomorphic unions. With *P. Sinensis* the proportion was nearly the same—namely, as 100 to 62. Now Gärtner has shown that, on the calculation of *Verbascum lychnitis* yielding with its own pollen 100 seeds, it yields when fertilized by the pollen of *V. Phœniceum* ninety seeds; by the pollen of *V. nigrum*, sixty-three seeds; by that of *V. blattaria*, sixty-two seeds. So again, *Dianthus barbatus* fertilized by the pollen of *D. superbus* yielded eighty-one seeds, and by the pollen of *D. Japonicus* sixty-six seeds, relatively to the 100 seeds produced by its own pollen. Thus we see—and the fact is highly remarkable—that the homomorphic unions relatively to the heteromorphic unions in *Primula* are more sterile than the crosses between several distinct species relatively to the pure union of those species.

The meaning or use of the existence in *Primula* of the two forms in about equal numbers, with their pollen adapted for reciprocal union, is tolerably plain; namely, to favour the intercrossing of distinct individuals. With plants there are innumerable contrivances for this end; and no one will understand the final cause of the structure of many flowers without attending to this point. I have already shown that the relative heights of the anthers and stigmas in the two forms lead to insects leaving the pollen of the one form on the stigma of the other; but, at the same time, there will be a strong probability of the flower's own pollen being likewise placed on the stigma. It is perfectly well known that if the pollen of several closely allied species be placed on the stigma of a distinct species, and at the same time, or even subsequently, its own pollen be placed on the stigma, this will entirely destroy the simultaneous or previous action of the foreign pollen. So again if the pollen of several varieties, including the plant's own pollen, be placed on the stigma, one or more of the varieties will take the lead and obliterate the effect of the others: but I have not space here to give the facts on which this conclusion is grounded. Hence we may infer as highly probable that, in *Primula*, the heteromorphic pollen which we know to be so much the most effective would obliterate the action of the homomorphic pollen when left on the flower's own stigma by insects; and thus we see how potent the dimorphic condition of the pollen in *Primula* will be in favouring the intercrossing of distinct individuals. The two forms, though both sexes are present in each, are in fact dioicous or unisexual. Whatever advantage there may be in the separation of the sexes, towards which we see so frequent a tendency throughout nature, this advantage has been here so far gained, that the one form is fertilized by the other, and conversely; and this is effected by the pollen of each form having less potency than that of the other on its own stigma.

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* Versuche über die Bastarderzeugung, 1849, s. 216.

Bearing on this view of the final cause of the dimorphism of the *Primulas*, there is another curious point. If we look at the right-hand figures of the four first lines in the previous tables of *P. Sinensis* and *veris*, we shall see that one of the homomorphic unions, namely, the short-styled by its own-form pollen, is considerably more sterile than the other; and in *P. auricula*, though here there is no other homomorphic union as a standard of comparison, this union is likewise excessively sterile. That the fertility of this union is really less in a marked degree than in the other three unions, we have an independent proof in the seeds germinating less perfectly and much more slowly than those from the other unions.

This fact is the more remarkable, because we have clearly seen that the short-styled form in the Cowslip in a state of nature is the most productive of seed. This form bears its anthers close together at the mouth of the corolla, and I observed long before I had ascertained the relative fertility of the four unions, in passing the proboscis of a dead Humble-bee or bristle down the the corolla, that in this form the flower's own pollen was almost certain to be left on its own stigma; and, as I wrote down at the time, the chance of self-fertilization is much stronger in this than in the other form. On this view we can at once understand the good of the pollen of the short-styled form, relatively to its own stigma, being the most sterile; for this sterility would be the most requisite to check self-fertilization, or to favour intercrossing. Hence, also, it would appear that there are four grades of fertility from the four possible unions in *Primula*; of the two homomorphic unions, as we have just seen, one is considerably more sterile than the other. In the wild state we know that the short-styled plants are more fertile than the long-styled; and we may infer as almost certain, that in the wild state, when the flowers are visited by insects, as is absolutely necessary for the production of seed, and when pollen is freely carried from one form to the other, that the unions are heteromorphic; if so, there are two degrees of fertility in the heteromorphic unions, making altogether four grades of fertility.

Two or three other points deserve a passing notice. The question whether the Primrose and Cowslip (*P. vulgaris* and *veris*) are distinct species or varieties has been more disputed and experimented on than in any other plant. But as we now know that the visits of insects are indispensable to the fertilization of these plants, and that in all probability the heteromorphic pollen of a Primrose would be prepotent on the stigma of a Cowslip over the homomorphic pollen of a Cowslip, the numerous experiments which have been made, showing that Oxlips appear amongst the seedlings of Cowslips, cannot be trusted, as the parent plants do not appear to have been carefully protected from insects*. I am far from wishing to affirm that pure Cowslips will not produce Oxlips, but further experiments are absolutely necessary. We may also suspect that the fact noticed by florists*, that the varieties of the Polyanthus never come true from seed, may be *in part* due to their habitually crossing with other varieties of the Polyanthus.

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* Mr. Sidebotham (Phytologist, vol. iii. pp. 703–5) states that he protected his plants from crossing; but as he gives in detail all the precautions which he took, and says nothing about artificial fertilization, we may conclude that he did not fertilize his plants. As he raised very numerous seedlings, he would have had to fertilize many flowers, if they had been really well guarded against the visits of insects. Hence I conclude that his results are not worthy of trust.

The simple fact of two individuals of the same undoubted species, when homomorphically united, being as sterile as are many distinct species when crossed, will surprise those who look at sterility as a special endowment to keep created species distinct. Hybridizers have shown† that individual plants of the same species vary in their sexual powers, so far that one individual will unite more readily than another individual of the same species with a distinct species. Seeing that we thus have a groundwork of variability in sexual power, and seeing that sterility of a peculiar kind has been acquired by the species of *Primula* to favour intercrossing, those who believe in the slow modification of specific forms will naturally ask themselves whether sterility may not have been slowly acquired for a distinct object, namely, to prevent two forms, whilst being fitted for distinct lines of life, becoming blended by marriage, and thus less well adapted for their new habits of life. But many great difficulties would remain, even if this view could be maintained.

Whether or not the dimorphic condition of the *Primulæ* has any bearing on other points in natural history, it is valuable as showing how nature strives, if I may so express myself, to favour the sexual union of distinct individuals of the same species. The resources of nature are illimitable; and we know not why the species of *Primula* should have acquired this novel and curious aid for checking continued self-fertilization through the division of the individuals into two bodies of hermaphrodites with different sexual powers, instead of by the more common method of the separation of the sexes, or by the maturity of the male and female elements at different periods, or by other such contrivances. Nor do we know why nature should thus strive after the intercrossing of distinct individuals. We do not even in the least know the final cause of sexuality; why new beings should be produced by the union of the two sexual elements, instead of by a process of parthenogenesis. When we look to the state in which young mammals and birds are born, we can at least see that the object gained is not, as has sometimes been maintained, mere dissemination. The whole subject is as yet hidden in darkness.

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* Mr. D. Beaton, in 'Journal of Horticulture,' May 28, 1861, pp. 154, 244.

† Gärtner, Bastarderzeugung, s. 165.

I will now only add that cases of dimorphism, like that of *Primula*, seem to be far from rare in the vegetable kingdom, though they have been little attended to. A large and important class of analogous facts will probably soon be discovered. Professor Asa Gray* informs me, that he and Dr. Torrey have described several Rubiaceous genera, in which some plants have exserted stamens, and others exserted pistils. "Mitchella offers an interesting instance of this structure from its relationship, through *Nertera*, to *Coprosma*, one of the few diœcious genera of *Rubiaceæ*, and in which the stamens are elongated in the male flowers and the styles in the females." The long-styled hermaphrodite flowers of Mitchella would probably be found more productive of seed than the short-styled; in the same way, but in a reversed manner, as in *Primula*, the short-styled flowers are more productive than the long-styled; from which fact I inferred that, if *Primula* were to become diœcious, the females would have short pistils and the males short stamens, these being the corresponding organs necessary for a heteromorphic union with full fertility. In the diœcious *Coprosma*, on the other hand, the females have long pistils, and the males have long stamens. These facts probably show us the stages by which a diœcious condition has been acquired by many plants.

Prof. A. Gray also informs me that another Rubiaceous genus (*Knoxia*) in India has been described by Dr. Wight, with a similar structure; and this, I am told, is the case with *Cinchona*. Several species of North American *Plantago* are dimorphic, as is *Rhamnus lanceolatus*, as far as its female organs are concerned. In the *Boragineæ*, Dr. Torrey has observed a strongly marked instance in *Amsinckia spectabilis*: in some dried flowers sent me by Prof. Gray, I find that the pistil in the one form is more than twice as long as in the other, with a corresponding difference in the length of the stamens; in the short-styled flowers the grains of pollen, as in *Primula*, apparently are larger, in the proportion of nine to seven, than in the long-styled flowers, which have the short stamens; but the difference can hardly be determined with safety in dried flowers.. In *Mertensia alpina*, another member of the *Boragineæ*, Prof. Gray finds a new and inexplicable case,—namely, some specimens with the stamens and pistil sub-exserted, and other specimens with *both* organs seated low down the tube of the corolla. Dr. Torrey and Prof. Gray have designated all such plants as "dioeciously dimorphous." In the *Labiatæ*, Mr. Bentham informs me that several species of *Ægiphyla*, and some of *Mentha*, are dimorphic like *Primula*. The case of *Thymus* is different, as I know from my own observations; but I will not here enlarge on this genus. Again, as I hear from Mr. Bentham, numerous species of *Oxalis* are similarly dimorphic. I can add the genus *Linum*. So that we already know of species (generally several in the same genus) having distinct dimorphic individuals, as far as structure is concerned, however it may prove in function, in no less than eight natural orders.

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* See also Prof. Asa Gray's 'Manual of the Botany of the N. United States,' 1856, p. 171. For *Plantago*, see p. 269.

With respect to *Linum*, I will not here enter on details, as I intend to try further experiments next summer; but I may state, that I observed many years ago two forms in *Linum flavum*, with both the pistils and stamens differing in length. In *Linum grandiflorum* there are likewise two forms which present no difference in their male organs, but the pistil and stigmatic surfaces are much longer in the one form than in the other. The short-styled form, I have good reason to believe, is highly fertile with its own pollen; whether it be more fertile with the pollen of the long-styled form, I cannot at present say. The long-styled form, on the other hand, is quite sterile with its own pollen: several plants grew in my garden, remote from the short-styled plants; their stigmas were coloured blue with their own pollen; but although they produced a vast number of flowers, they did not produce a single seed-capsule. It seemed a hopeless experiment; but I had so much confidence from my trials on *Primula*, that I put a little pollen from the short-styled plants on the stigmas (already blue with their own pollen) of twelve flowers on two of the long-styled plants. From these twelve flowers I got eight remarkably fine seed-capsules; the other flowers not producing a single capsule. The existence of plants in full health, and capable of bearing seed, on which their own pollen produces no more effect than the pollen of a plant of a different order, or than so much inorganic dust, is one of the most surprising facts which I have ever observed.

# Notes on *Malvaceæ* and *Sterculiaceæ*. By GEORGE BENTHAM, Esq., P.L.S.

[Read June 20, 1861.]

BOTANISTS appear to be unanimous in bringing together the group of orders designated by Endlicher under the name of *Columniferæ*, by Brongniart under that of *Malvoideæ*, and included by Lindley in his alliance of *Malvales*. They are characterized generally by the valvate calyx, contorted petals, monadelphous or indefinite stamens, and syncarpous ovary; and as to habit, by alternate stipulate leaves often toothed or palmately lobed, and a great tendency to stellate pubescence. The subdivision of the group, however, has been the object of much diversity of opinion. Whilst A. de St. Hilaire proposed the adoption of two orders only, Malvaceæ and Tiliaceæ, the greater number of modern botanists have admitted one or two intermediate ones, Sterculiaceæ and Buettneriaceæ; whilst others enumerate as many as nine distinct orders, Malvaceæ, Bombaceæ, Sterculiaceæ, Lasiopetaleæ, Buettneriaceæ, Hermanniaceæ, Dombeyaceæ, Tiliaceæ, and Elæocarpeæ. The Tiliaceæ, including Elæocarpeæ, characterized by indefinite free or nearly free stamens with 2-celled anthers, have been the subject of a previous paper (Linn. Journ. v. 2nd Suppl.). I have now to offer a few observations on the Malvaceæ as understood by St. Hilaire, characterized by monadelphous stamens, or, in the very few cases where they are free, definite and alternate with the sepals.

There is so much intercommunity, both in habit and character, in the various orders or tribes of this group, that the proposal for their union, although not generally adopted, was perhaps the most in conformity to the general principles of the natural method; yet there is one character, derived from the one- or two-celled anthers, which seems to divide them into two large groups, Malvaceæ and Sterculiaceæ, accurately limited (with the exception of a very few species, whose affinities are, by other characters, placed beyond doubt) and not unnatural; and this classification we propose to adopt, in common with the majority of modern botanists, although not with the usual limits. For Bombaceæ, usually classed as a tribe of Sterculiaceæ, have the one-celled anthers of Malvaceæ; and, in their accessory characters, their soft wood, their staminal arrangement, the cotton within the capsule of so many of them, show a nearer connexion with some of the arborescent Hibisceæ than with any true Sterculiaceous genera. It is true that the smooth pollen-grains have been adduced as a positive character connecting them rather with Sterculiaceæ than with Malvaceæ, but its constancy is very far from being proved. The pollen has only been described in a very few genera. As far as my observation goes, it is always tuberculate or muricate in what are considered as true Malvaceæ; but so I have found it also in *Hampea*, in several Helicteroid genera, &c.; so that, in the present state of our knowledge, the pollen cannot be taken as furnishing an ordinal character.

Although the one-celled anthers are thus taken by common consent as the essential characters of Malvaceæ, on account of its remarkable constancy in genera otherwise related, yet it is of very little organic importance. It is not occasioned by the constant abortion of one cell, but by the two cells, placed end to end as in many distinctly two-celled genera, but confluent from a very early period. In many genera no trace of any transverse partition or even contraction can, I believe, be traced at any age; in others, in the young bud, there is a distinct contraction in the middle of the anther, showing its normal structure. *Helicteres*, which on many accounts belongs undoubtedly to Sterculiaceæ, shows, in regard to the anthers, the passage from the Malvaceous confluent anthers of *H. pentandra*, &c., to the Sterculiaceous distinctly two-celled ones of *H. angustifolia*, &c.; but here the contraction in the young anthers may, I believe, be found in all the species.

MALVACEÆ have been distributed into tribes, and the genera circumscribed with so much tact and ability by A. Gray, that I have little to propose in modification of his arrangement, except the addition of one or two genera which had not come under his observation, and the annexation of Bombaceæ,—in consequence of which I should propose reducing some of his tribes to the rank of subtribes, as will appear in the following enumeration of tribes and genera.

Tribus I. MALVEÆ. Columna staminea apice v. usque ad apicem antherifera. Styli rami tot quot ovarii loculi v. carpella. Carpella matura ab axi v. receptaculo secedentia (exceptis *Bastardia* et *Howittia*).

Subtribus 1. MALOPEÆ. Carpella inordinate congesta. Ovula solitaria, adscendentia.

* *Styli rami longitudinaliter stigmatosi.*

Genus:—1. Malope, *Linn.*

** *Styli rami apice stigmatosi.*

Genera:—2. Kitaibelia, *Willd.*; 3. Palava, *Cav.*

Subtribus 2. Eumalveæ. Carpella simplici serie verticillata. Ovula solitaria, adscendentia.

* *Styli rami intus longitudinaliter stigmatosi.*

Genera:—4. Althæa, *Cav.*; 5. Lavatera, *Linn.* (*Stegia*, Mœnch; *Saviniona*, Webb; *Navæa*, Webb); 6. Malva, *Linn.* (ex parte); 7. Callirhoe, *Nutt.*; 8. Sidalcea, *A. Gray*; 9. Napæa, *Linn.*

** *Styli rami apice stigmatosi.*

Genus:—10. Malvastrum, *A. Gray.*

Subtribus 3. Sideæ. Carpella simplici serie verticillata. Ovula solitaria, pendula.

* *Styli rami intus longitudinaliter stigmatosi.*

Genus:—11. Plagianthus, *Forst.* (*Philippodendron*, Poit.; *Asterotrichon*, Klotzsch; *Blepharanthemum*, Klotzsch; *Lawrencia*, Hook.; *Wrenciala*, A. Gray.

** *Styli rami apice stigmatosi.*

Genera:—12. Hoheria, *A. Cunn.*; 13. Anoda, *Cav.*; 14. Cristaria, *Cav.*; 15. Gaya, *H. B. & K.*; 16. Sida, *Linn.* (ex parte) (*Dictyocarpus*, Wight; *Fleischeria*, Steud.); 17. Bastardia, *H. B. & K.*

Subtribus 4. Abutileæ. Carpella simplici serie verticillata. Ovula 2–∞ (excepta *Wissadula divergente*), sæpius adscendentia, nunc alia pendula, alia adscendentia.

Genera:—18. Howittia, *F. Müll.*; 19. Kydia, *Roxb.*; 20. Wissadula, *Medik.*; 21. Abutilon, *Gærtn.* (*Beloere*, Shuttlew.; *Bastardiæ* sect. *Gayoides*, Endl.); 22. Sphæralcea, *A. de St. Hil.* (*Sphæroma*, Harv.; *Meliphlœa*, Zucc.); 23. Modiola, *Mœnch.*

Tribus II. Ureneæ. Columna staminea extus antherifera, apice truncata v. 5-dentata. Styli rami numero carpellorum dupli. Carpella 5, matura ab axi v. receptaculo secedentia.

Genera:—24. Malachra, *Linn.*; 25. Urena, *Linn.*; 26. Pavonia, *Cav.* (*Lebretonia*, Schranck; *Greevesia*, F. Müll.; *Lopimia*, Nees et Mart.; *Asterochlæna*, Garcke); 27. Goethea, *Nees & Mart.*; 28. Malvaviscus, *Dillen.* (*Achania*, Sw.).

Tribus III. Hibisceæ. Columna staminea extus antherifera, apice truncata v. 5-dentata, v. rarissime antherifera. Stylus in ramos tot quot ovarii loculi divisus v. subinteger. Capsula loculicide dehiscens, carpellis non secedentibus.

Genera:—29. Kosteletzkya, *Presl*; 30. Decaschistia, *W. & Arn.*;

31. Julostyles, *Thw.*; 32. Senra, *Cav.*; 33. Hibiscus, *Linn.* (*Bombycodendron*, Zoll.; *Lagunæa*, Cav.; *Abelmoschus*, Medik.; *Paritium*, A. de St. Hil.); 34. Thespesia, *Corr.*; 35. Fugosia, *Juss.* (*Redoutea*, Vent.); 36. Thurberia, *A. Gray*; 37. Gossypium, *Linn.* (*Sturtia*, R. Br.); 38. Lagunaria, *Don.*

Tribus IV. (v. Subordo) BOMBACEÆ. Columna staminea plus minus divisa in filamenta v. ramos 5–∞, singula 2–8-antherifera, v. rarius subintegra. Stylus integer v. in ramos tot quot ovarii loculos divisus. Capsula loculicide dehiscens v. indehiscens, carpellis non v. vix rarissime secedentibus.

Subtribus 1. ADANSONIEÆ. Folia digitata. Bracteolæ distinctæ v. 0.

* *Columna staminea superne in filamenta numerosa soluta.*

Genera:—39. Adansonia, *Linn.*; 40. Pachira, *Aubl.* (*Carolinea*, Linn. fil.); 41. Bombax, *Linn.* (*Eriotheca*, Schott; *Salmalia*, Schott).

** *Columna staminea 5-fida v. 5-dentata, ramis 2–3-antheriferis.*

Genera:—42. Eriodendron, *DC.* (*Erione*, *Campylanthera*, et *Gossampinus*, Schott); 43. Chorisia, *H. B. & K.*

Subtribus 2. MATISIEÆ. Folia simplicia palmatinervia v. saltem basi 3-nervia. Bracteolæ distinctæ v. 0.

* *Petala* 5. *Filamenta* 1-*antherifera*, 5–10-*adelpha v. libera.*

Genera:—44. Hampea, *Schlecht.*; 45. Scleronema, *Benth.*; 46. Cavanillesia, *Ruiz & Pav.* (*Pourretia*, Willd., non R. & P.).

** *Petala* 5. *Antheræ secus columnam v. ejus ramos adnatæ.*

Genera:—47. Matisia, *Humb. & Bonpl.*; 48. Quararibea, *Aubl.*; 49. Montezuma, *DC.*; 50. Ochroma, *Sw.*

*** *Petala* 0. *Antheræ* 10, *lineares, per paria ramis columnæ adnatæ, antheras* 5 *biloculares simulantes.*

Genera:—51. Cheirostemon, *Humb. & Bonpl.*; 52. Fremontia, *Torr.*

Subtribus 3. DURIONEÆ. Folia simplicia penninervia integerrima subtus uti inflorescentiæ lepidota. Involucrum calycem cingens, demum varie fissum. Fructus muricatus.

Genera:—53. Cullenia, *Wight*; 54. Durio, *Rumph.*; 55. Lahia, *Hassk.*; 56. Boschia, *Korth.* (*Heteropyxis*, Griff.); 57. Neesia, *Blume* (*Cotylephora*, Meisn.).

A detailed monograph of several of the above genera, especially of those which, like *Sida*, *Abutilon*, *Pavonia*, *Hibiscus*, &c., contain numerous widely spread species, is much wanted, but would lead me too far on the present occasion; nor can I stay to investigate or describe many apparently unpublished forms which we possess in our herbaria. There are, however, a few genera on which I should wish to add some observations, or to characterize some of the more remarkable new species.

### PALAVA, *Cav.*

The *P. rhombifolia*, Grah., from Lima, is probably the same species as the *P. malvifolia*, Cav., of which the latter author had probably only examined undeveloped flowers, and thus described the petals as of the length of the calyx. *P. moschata*, Cav., is a very distinct species; and the following one, with the habit of a *Cristaria*, appears to have been hitherto overlooked.

P. DISSECTA, sp. n., tomentosa, foliis profunde bipinnatifidis dissectisve, lobis cuneato-oblongis obtusis integris v. 3–5-lobis, pedunculis calycibusque hispidis.

*Hab.* Peru, *Cuming*, n. 945; near S. Lorenzo, *Maclean*.

### MALVA, *Linn.*

This genus, stripped as it has been by A. Gray of its American and South-African species, becomes at once more natural and better characterized. Amongst European ones, the *M. Sherardiana*, Linn., notwithstanding the almost constant presence of two small bracts, must be referred to *Sida*, of which it has the styles and the seeds. *M. Behriana*, Schlecht., Linnæa, xx. p. 633, from Australia, is *Lavatera plebeia*, Br.

### PLAGIANTHUS, *Forst.*

Notwithstanding the close proximity of this Australian genus to *Sida*, most of the species have, under various names, been published as Sterculiaceous genera; for the longitudinal partition in the anthers (much more prominent than in the generality of Malvaceæ) has usually suggested the idea of their being really bilocular. In some species also the ovary is reduced to three, two, or even a single carpel, so as, at least in the latter case, to give readily a false idea of its structure; and one such species, very nearly allied to the original one of Forster, has even been considered as the type of a distinct natural order under the name of *Philippodendreæ*, the affinities of which have much puzzled those who only knew the plant from Poiret's figure and description. The true position of the group among Malvaceæ has now, however, been fully shown by Hooker, A. Gray, Garcke, and others, where, with the ovary and seeds of Sideæ, it is distinguished from the other genera of that subtribe by the styles either clavate or acute, stigmatic along their inner edge or surface as in most Malveæ.

Two genera have been generally distinguished—*Plagianthus* and *Lawrencia*; but the characters which separate them appear to be too inconstant and too little in conformity with habit to be considered as more than sectional. The ovary in *Plagianthus* consists usually of only one or two carpels, but sometimes of three; whilst in *Lawrencia*, although usually five, there are occasionally three only. The more or less clavate or attenuate styles vary also from species to species. The 5-angular calyx of *Lawrencia* is more constant, but even that is not always well marked; and in habit the smaller-leaved *Lawrencias* are much nearer to some of the *Plagianthi* than to *L. spicata.* I should therefore propose to include the whole of the following species in *Plagianthus*.

Sect. 1. PLAGIANTHUS. Calyx campanulatus angulis vix prominulis.

* *Styli apice valde dilatati. Carpella vulgo 1–2, rarius 3.*

1. *P. betulinus*, A. Cunn. Hook. fil. Fl. N. Zel. i. 29.—*P. urticinus*, A. Cunn.—*Philippodendron regium*, Poir. in Ann. Sc. Nat. Par. sér. 2. viii. p. 183, t. 3.—New Zealand.

2. *P. divaricatus*, Forst.; Hook. Bot. Mag. t. 3271; Hook. fil. Fl. N. Zel. i. 29.—New Zealand.

3. *P. sidoides*, Hook. Bot. Mag. t. 3396.—*Sida discolor*, Hook. Journ. Bot. i. 250.—*Asterotriche sidoides*, Link, Klotzsch et Otto, Ic. Pl. Rar. t. 8.—*Plagianthus Lampenii*, Lindl. Bot. Reg. 1838, Misc. p. 22. —Tasmania.

** *Styli apice clavati. Carpella vulgo 5.*

4. *P. pulchellus*, A. Gray; Hook. fil. Fl. Tasm. i. 49, excl. var. β.—*Sida pulchella*, Bonpl., Hook. Bot. Mag. t. 2753.—Tasmania and Victoria.

The *P. petiolaris*, Backh. MS., from Illawarra, and *Croton urticoides*, A. Cunn. MS., from the margins of Cox's and Macquarie's Rivers, appear to be the same species; but the specimens I have seen have none but male flowers. The *Sida pulchella*, Bonpl., has been described by DeCandolle as having 2-ovulate 2-aristate carpels, which is totally at variance with our plant. I have, however, ascertained (since the present paper was read), by the inspection of Bonpland's original specimens, that the reference is correct.

*** *Styli apice attenuati. Carpella vulgo 5.*

5. *P. tasmanicus.*—*Sida tasmanica,* Hook. fil. in Hook. Journ. Bot. ii. 412.—*P. pulchellus,* var. β, Hook. fil. Fl. Tasm. i. 49.—Tasmania; also Southern Australia, on the rivers Tambo and Buchan, *F. Müller.*

6.? *P.* sp.?—*Sida dictyocarpa,* Ferd. Müll. MS.—*Sida spicata,* Backh. MS., non Cav.—On the Brisbane River, *Fraser, F. Müller*; Kirkton on the Upper Hunter River, *Backhouse.*

The foliage, indumentum, and inflorescence are those of *P. sidoides,* but the flowers are more crowded and sessile. Calyx shorter, broadly campanulate. Carpels usually five, strongly reticulate. A very distinct species; but the specimens are insufficient to assign its exact place.

**** *Styli superne subclavati. Carpella ∞, matura membranacea, valde compressa.*

7. *P. Lyallii,* Hook. fil. MS.—*Hoheria Lyallii,* Hook. fil. Fl. N. Zel. i. 31, t. 11.—N. Zealand.

This plant appears to me to be much better placed in *Plagianthus* than in *Hoheria,* reducing the latter genus to the single *H. populnea,* which has terminal peltate stigmas and remarkably winged carpels.

Sect. 2. LAWRENCIA. Calyx 5-angulatus, sæpe turbinatus. Styli apice attenuati. Carpella 3–5, nonnulla sæpe abortientia.

8. *P. spicatus.*—*Lawrencia spicata,* Hook. Ic. Pl. t. 261, 262.—Tasmania and Southern and Western Australia, from Port Fairy to Swan River.

9. *P. glomeratus.*—*Lawrencia glomerata,* Hook. Ic. Pl. t. 417.—Swan River, *Drummond.*

10. *P. squamatus.*—*Lawrencia squamata,* Nees, Pl. Preiss. i. 242.—Swan River, *Preiss*; *Drummond,* 4th coll. n. 106.

11. *P. microphyllus,* F. Müll. Fragm. Phyt. Austr. i. 29.—Victoria, *F. Müller*; Swan River, *Drummond,* coll. 1845, n. 208, and 4th coll. n. 252.

### SIDA, *Linn.*

*Dictyocarpus,* Wight, has already been restored to this genus; and *Fleischeria,* Steud. (Steetz in Pl. Preiss. ii. 365), consisting of the single *Sida calyxhymenia,* Gay (DC. Prod. i. 462), only differs from other species in the calyx more enlarged, spreading and membranous after flowering—a character which appears to us wholly insufficient to justify the establishing a monotypic genus.

### BASTARDIA, *H. B. & K.*, and HOWITTIA, *F. Müll.*

These two genera differ from the whole tribe of Malveæ in their capsule truly loculicidal as in Hibisceæ, without any tendency to the septicidal separation so universal in other Malveæ. Yet the habit and the staminal column are so completely those of *Sida* and its allies, that they are better placed in their vicinity as exceptional genera, than removed to Hibisceæ, with which they have little else in common. *Bastardia* must, of course, be reduced, as proposed by Grisebach and others, to the two original species, *B. viscosa* and *B. bivalvis*, Kunth. The *B. crispa*, St. Hil., and *B. nemoralis*, St. Hil., have several ovules in each carpel, although most frequently only one comes to maturity. They form the section *Gayopsis* of *Abutilon*, a section including *A. asiaticum*, Don, &c., and proposed by Shuttleworth to be raised to the rank of a genus, under the name of *Beloere*.

### WISSADULA, *Medik.*

This small genus, closely allied to *Abutilon*, is adopted by A. Gray and others on account of the transverse projection inside each carpel dividing it into two cells, analogous to the inner appendages which form the character separating *Callirhoe* from *Malva*, and *Modiola* from *Sphæralcea*. It should, however, include, as proposed by Planchon, the *Sida divergens*, Benth., notwithstanding the want of any ovule in the upper portion of the carpels, the lower portion containing a single one. Grisebach on this account retains it as a section of *Sida*, under the name of *Wissada*; but, besides the rudimentary transverse dissepiment and the habit, which separate it from *Sida* and bring it under *Wissadula*, the shape of the fruit indicates its connexion with the latter, and not with the former. In all *Sidas* the upper angle is on the inner edge next the axis, so that when lengthened into a point or awn these points are always erect or connivent; whilst in *Wissadula*, as in most *Abutilons*, the upper angles or points are more or less divergent or divaricate, giving a peculiar flat top to the fruit. In the remaining *Abutilons* (chiefly of the section *Gayopsis*) the carpels are rounded at the top, but never have the inner angles or connivent points of *Sida*.

### ABUTILON, *Gærtn.*

The *A. vitifolium* (*Sida*, Cav.) and, perhaps, a few other South-Western American species differ slightly from the rest of the genus in the more clavate branches of the style with less strictly terminal stigmas; but, as far as I am aware, the character is scarcely sufficiently marked to form even a good section.

### SPHÆRALCEA, *A. de St. Hil.*

Harvey proposes to distinguish under the name of *Sphæroma* two species which differ from the others, as *Lavatera* from *Malva*, by the bracts connate at the base, and which has appeared in the Cape species to be confirmed by a difference in habit. But when the American species come to be examined, it will be found that the free and connate bracts pass gradually the one into the other, without any relation to habit or other characters. As to the rule that if a character separates two good genera in one part of a natural order, it must be considered as generic throughout the order, it is a very unsafe one, and the attempted strict adherence to it has been one of the causes of the raising so enormous a number of isolated species to bad genera, and of the consequent confusion, in Cruciferæ, Umbelliferæ, Compositæ, &c.

*Meliphlœa*, Zucc., a single Mexican species, has been distinguished from *Sphæralcea* by its connate bracts, by the calyx marked inside at the base by a smooth five-lobed portion scarcely thickened enough to be called a disk, and by clavate styles with the stigmas less strictly terminal; but all these characters may be observed, although in a much less degree, in other species passing gradually into the typical form. It is probable, however, that, when better known, the red-flowered species, such as *S. umbellata*, *S. rosea*, &c., may, with Zuccarini's *Meliphlœa*, form a good section of *Sphæralcea*, whilst *Sphæroma* would constitute a third section.

### URENA, *Linn.*

As no character has been found to separate this genus from *Pavonia* except the glochidiate points covering the fruit, the *U. speciosa*, Wall., must be transferred to *Pavonia*, in which many species have connate bracts.

### PAVONIA, *Cav.*

There are about 60 species known of this genus, varying considerably in habit and in several minor characters derived chiefly from the bracts and the shape and degree of dehiscence of the cocci; and it would require a careful monographic examination of the whole to determine how far the genus is divisible into good sections, and what are the limits to be assigned to it with reference to the closely allied genera *Urena*, *Goethea*, and *Malvaviscus*. *Le-*

*bretonia*, Schranck, with five broad bracts and indehiscent cocci (sometimes muricate almost as in *Urena*), and *Lopimia*, Nees and Mart., with numerous narrow bracts and the cocci enveloped in mucilage, have now been generally reunited with *Pavonia*, as being connected with other species by intermediate forms. An Australian variety of *P. hastata*, Cav., has been established by F. Müller as a genus under the name of *Greevesia*, as having dimorphous flowers—perfect ones with the usual petals, together with abnormal pentandrous ones with small closed corollas. This is hitherto, as far as I am aware, the only instance observed in Malvaceæ, as the *Stellarias* of the group of *Krascheninikowia* are among Caryophylleæ, but in neither case supplying a good generic character any more than in the numerous other orders where it is now known to occur.

*Asterochlæna*, Garcke, from the character given in the Bot. Zeit. 1850, p. 666, does not appear in any way to differ from other *Pavonias* with more or less dehiscent cocci.

*Goethea*, Nees et Mart., has also been united with *Pavonia*; yet, in two species known to me, the habit and inflorescence, the large coloured calyx, short corolla, &c., seem to indicate differences more important than those which separate *Urena*. The *G. semperflorens*, Mart., however, only known to me from Martius's figure, may possibly sufficiently connect *Goethea* with species of true *Pavonia* to justify the considering it as a section only.

*Malvaviscus*, Dillen., with erect petals and a baccate fruit, seems at first sight very different from *Pavonia*; but the former character occurs in several true *Pavonias*, and the succulence of the fruit is variable in degree in different species of *Malvaviscus*. It is, however, known only in a very few, and whether it passes or not into the slightly mucilaginous outer coating of the carpels of *Lopimia* remains to be ascertained. Another character has been pointed out, which, if true, may be important,—that is, that the carpels are said to alternate with the petals in *Malvaviscus*, and to be opposite them in *Pavonia*. I have been unable to verify this character satisfactorily in our dried specimens. It is only in the fresh flower that it can be ascertained whether it may not be due to a greater or less degree of torsion, to which there is a tendency in many Malvaceæ.

### JULOSTYLES, *Thw.*

This is a Ceylon tree, which, from some general resemblance in calyx and in habit to *Kydia*, had been published by Gardner as a second species of that genus. Thwaites very properly established it as distinct on numerous grounds, and pointed out the truly Malvaceous character of its anthers. As the structure of the staminal column is also Malvaceous (except that the stamens appear to be limited to ten), as the pollen is remarkably muricate, and as the shape of the corolla with the dark spot at the base of the petals is so much like that of *Hibiscus*, there appears no reason against removing it to the tribe Hibisceæ of Malvaceæ, of which it has all the technical characters. The original species of *Kydia* must also be removed to Malvaceæ, as having truly one-celled anthers; but their shape, as well as the general structure of the staminal column, places the genus in Abutileæ rather than in Hibisceæ.

## HIBISCUS, *Linn.*

This, the largest genus among Malvaceæ, comprising about 150 known species, varies more than any other in the calyx and bracts, in the woolly or glabrous seeds, &c.; but the characters appear to us to be too much blended together, or to pass too much one into the other in many instances, to be considered as more than sectional. We would therefore restore to *Hibiscus* the proposed genera *Bombycodendron*, Zoll. (sect. *Bombycella*, DC.), *Lagunæa*, Cav., *Paritium*, A. de St. Hil., and even *Abelmoschus*, Medik. On the other hand, *Thespesia*, Corr., appears to be sufficiently distinct in the calyx, in the clavate style, and in the hard, almost woody fruit, although not always indehiscent even in *T. populnea*, as well as in the apparently constant character of the obovoid, not reniform, seeds: the genus should, however, include the *H. Lampas* and its allies, forming Garcke's subsection *Tiparium* of DeCandolle's section *Azanza*.

## Tribe BOMBACEÆ.

I have already given the principal reasons for which I should consider the Bombaceæ as a tribe or suborder rather of Malvaceæ than of Sterculiaceæ, and have observed that it is chiefly with the arborescent Hibisceæ that they stand in close connexion. *Hampea*, indeed, and some allied genera are scarcely separated from them, except by the filaments all terminating the staminal column without any barren truncate or 5-toothed edge; and the latter character is not even quite constant in Hibisceæ, for in some species of *Lagunaria* and *Gossypium* the column is divided to the summit into antheriferous filaments. Some genera of Bombaceæ present indeed exceptional characters, never or seldom observed either in other Malvaceæ or in Sterculiaceæ; but these are generally limited to a few genera only, or are too variously combined to warrant the maintenance of the group as a distinct order. Thus, the digitate leaflets of the five first genera are unknown in Malvaceæ and Tiliaceæ, and in Sterculiaceæ only occur in a very few species of *Sterculia.* The bracteoles in most Bombaceæ are small and inconspicuous, as in *Fugosia,* &c.; but in the subtribe Durioneæ they are united in an involucre which is often entire, completely enclosing the young bud, and bursting irregularly as the calyx enlarges. The calyx, sometimes truncate and toothed as in *Thespesia,* &c., or more rarely 5-cleft as in most Malvaceæ and Sterculiaceæ, is more frequently entire in the young bud, splitting irregularly into three to five lobes as the flower expands. This is rare in Malvaceæ and Sterculiaceæ, but occurs in the subtribe Brownlowieæ of Tiliaceæ. In *Ochroma, Cheirostemon,* and *Fremontia* the generally thick calyx-lobes are more or less expanded on the sides into thinner imbricating edges, which is quite exceptional among Columniferæ. The staminal column, usually more or less Malvaceous, is in *Eriodendron, Chorisia, Cheirostemon,* and *Fremontia* exceptionally divided into five lobes, each of which usually bears two long linear parallel adnate anthers, which might easily be taken at first sight for the parallel cells of single anthers, were it not that these are occasionally three instead of two, that the two are often not strictly parallel, one being longer or inserted rather higher up than the other, and that their real nature is shown by a comparison with the more numerous but similarly adnate anthers of *Matisia, Quararibea,* and *Ochroma.* As a further evidence of the close connexion of Bombaceæ with Hibisceæ, I may observe that since the above was read we have received some numbers of the 'Botanische Zeitung,' in which Alefeld proposes to remove *Gossypium, Thespesia,* and their allies from Hibisceæ to Bombaceæ.

### BOMBAX, *Linn.*

*Bombax* differs chiefly from *Pachira* in its shorter flowers and in the dense wool enveloping the seeds within the capsule. In *Pachira humilis,* Spruce, and *P. Fendleri,* Seem., the flowers are longer than is usual in *Bombax*; yet as the capsule is woolly inside as in the latter genus, these two species must be transferred to it. The small-flowered *Eriothecas* and the Indian *Salmalia,* proposed as separate genera by Schott, do not appear to be founded on any better character than the greater or less degree of union of the stamens in pairs, which is variable in the same species; and we therefore propose their reunion with *Bombax*. Nor can we see any sufficient grounds for the adoption of *Erione*, *Campylanthera*, and *Gossampinus*, proposed by the same author for single species of *Eriodendron*.

### SCLERONEMA, *Benth.*

I give this name to a North-Brazilian plant of Mr. Spruce's, which on a hasty determination I had thought might be a new species of *Myrodia*, taken in the vague general limits usually given to the genus; but, having now more closely investigated the characters of that and other Bombaceous genera, I find that it is much more nearly connected with *Hampea*. The fruit is still unknown, but the flower presents too many points of difference to admit of its being incorporated with that or any allied genus. I therefore propose it as a new genus with the following technical character:—

SCLERONEMA. *Char. gen.*—Calyx campanulatus, sub-5-lobus. Petala 5. Columna staminea brevis, apice divisa in filamenta ∞ (circa 20) superne incrassata, exterioribus brevioribus. Antheræ terminales, adnatæ, breves, uniloculares. Ovarium 2-3-loculare, ovulis in loculis geminis collateraliter ascendentibus. Stylus apice vix incrassatus, minute 2–3-dentatus. Fructus.........

Species unica. S. SPRUCEANA, Benth.—Arbor 100-pedalis, trunco 5 pedes diametro; corona patula. Stipulæ parvæ. Folia alterna, ovali-elliptica v. obovata, breviter et abrupte acuminata, 2–4-pollicaria, petiolo ½–1-pollicari, integerrima, coriacea, glaberrima, nitida, penninervia et basi subtrinervia, costa venisque utrinsecus primariis 6–8 obliquis subtus prominulis; venulæ transversæ, crebræ, reticulatæ. Flores haud magni, in axillis solitarii v. 2–3-ni. Pedicelli 3–4 lin. longi, crassiusculi, minute tomentelli. Bracteolæ sub calyce 2 v. 3, parvæ, calyce multo breviores. Alabastra obovoidea. Calyx apertus 3 lin. longus, fere ad medium sub-5-fidus. Petala duplo longiora, rubra, anguste oblonga, glabra, patentia, in unguem angustata. Tubus stamineus 2 lin. longus, filamenta, præsertim interiora, paullo longiora.

*Hab.* In North Brazil, on the Rio Uaupès, in *Caatingas* about the cataracts of Jauaratè, where these tall trees project here and there from the mass of low trees and shrubs. R. Spruce, n. 2548. Distributed under the name of *Myrodia parviflora*.

### CARPODIPTERA, *Griseb.*

This genus, established by Grisebach on a Cuban plant of Wright's, and which I had at first, following that author, placed among Bombaceæ, proves on examination to differ from all others of the family as well in its stamens and its pendulous ovules as in its fruit and general habit. It is indeed so closely allied to *Berrya* among Tiliaceæ as only to be distinguishable from that genus by the singular, almost petaloid sessile stigmas, and we have accordingly now removed it to the latter family. Among the Kew-Garden drawings is one of a plant of unknown origin, which is evidently the same *Carpodiptera*, although there are three stigmas, instead of two as in the Cuban specimens.

### QUARARIBEA, *Aubl.*

This genus is generally referred as a section to *Myrodia*, which it resembles in its fruit, although the flowers are very different. The androecium, with its one-celled anthers, is truly Bombaceous, near that of *Matisia*; whilst in *Myrodia* the anthers, in their two parallel or diverging cells, and in their usually definite number and arrangement, are decidedly Sterculiaceous, closely resembling those of several genera of the Helictereæ.

### Subtribe DURIONEÆ.

Of the five genera forming this subtribe three are monotypic, and the two others have only two species each. They have, moreover, so much general similarity in their habit, in their scaly indumentum, in their involucre and fruit, that they might have been considered as constituting a single genus. Yet there is so much diversity in their calyx, in the presence and absence of petals, in their style, in the number of ovules, and especially in their androecium, that we have, for the present, thought it better to preserve the five genera as usually adopted. Two of them (*Neesia* and *Boschia*) have been occasionally placed among Tiliaceæ, from which they are readily known by their anthers.

The distinction between STERCULIACEÆ and BUETTNERIACEÆ, taken each in their general sense, although adopted by most botanists, rests on no one tangible character. In both, the number of stamens usually bears some definite ratio to that of the sepals. The supposed introrse anthers of Buettneriaceæ originated in a mistake. The "sterile stamens" of most tribes of Buettneriaceæ are the same thing as the "teeth of the staminal column" in *Helicteres* and its allies, and the degree of connation of the stamens varies in both supposed orders. In both also we meet with great diversity in the dehiscence of the fruit and in the embryo and albumen. If, however, we unite the two, rejecting only the

Bombaceæ already absorbed in Malvaceæ, we have a more definite group,—closely allied, it is true, to Malvaceæ, but readily separated by their two-celled anthers; and differing rather more from Tiliaceæ in habit, in their stamens either prominently monadelphous or definite either singly or in fascicles alternating with the sepals. In the few cases where genera with shortly monadelphous stamens have been admitted into Tiliaceæ, they may be known by their pendulous ovules with a ventral raphe, a character very frequent in Tiliaceæ, but, as I believe, unknown in Malvaceæ or Sterculiaceæ. At the same time, the large order of Sterculiaceæ thus formed, consisting of 41 genera and between 500 and 600 species, may be divided into the following seven distinct, well-marked, and for the most part natural tribes.

Tribus I. STERCULIEÆ. Flores unisexuales v. polygami. Calyx sæpe coloratus. Petala 0. Antheræ 5–15 ad apicem columnæ congestæ, brevissime 5-adelphæ v. annulatæ. Carpella fructus libera.

* *Antheræ inordinate congestæ. Semina albuminosa.*

Genera:—1. Sterculia, *Linn.* (*Triphaca*, Lour.; *Ivira*, Aubl.; *Southwellia*, Salisb.; *Chichæa*, Presl, v. *Mateatia*, Vell.; *Cavallium*, Schott; *Firmiana*, Marsigl.; *Erythropsis*, Lindl.; *Brachychiton*, Schott; *Pœcilodermis*, Schott; *Trichosiphon*, Schott; *Delabechea*, Lindl.; *Pterygota*, Schott; *Hildegardia*, Schott; *Scaphium*, Schott; *Pterocymbium*, R. Br.); 2. Tarrietia, *Blume* (*Argyrodendron*, F. Müll.).

** *Antheræ uniseriatim annulatæ. Albumen* 0.

Genera:—3. Cola, *Schott* (*Courtenia*, R. Br.); 4. Heritiera, *Ait.*; 5.? Tetradia, *R. Br.*

Tribus II. HELICTEREÆ. Flores hermaphroditi. Petala 5, decidua. Antheræ 5–15 ad apicem columnæ elongatæ sessiles v. stipitatæ, per 1–3 cum dentibus columnæ (raro obsoletis) v. staminodiis 5 linearibus v. ligulatis extrorsum alternantes. Cotyledones integræ.

* *Ovarium intra basin columnæ sessile. Antheræ sessiles.*

Genus:—6. Myrodia, *Schreb.* (*Lexarza*, Llav.).

** *Ovarium gynophoro columnæ adnato fultum. Antheræ sessiles. Calyx clavato-campanulatus.*

Genera:—7. Reevesia, *Lindl.*; 8. Ungeria, *Endl.*

*** *Ovarium gynophoro columnæ adnato fultum. Antheræ stipitatæ. Sepala demum libera.*

Genera:—9. Kleinhovia, *Linn.*; 10. Helicteres, *Linn.* (*Methorium*, Schott; *Oudemansia*, Miq.; *Isora*, Schott; *Alicteres*, Schott; *Orthothecium*, Schott); 11. Pterospermum, *Schreb.*

Tribus III. ERIOLÆNEÆ. Flores hermaphroditi. Petala 5, decidua. Antheræ ∞ a medio ad apicem columnæ extrorsum stipitatæ. Staminodia 0.

Genus:—12. Eriolæna, *DC.* (*Wallichia*, DC.; *Microlæna*, Wall.).

Tribus IV. DOMBEYEÆ. Flores hermaphroditi. Petala 5, plana, sæpius persistentia. Antheræ 10–20 v. in *Melhania* 5, ad apicem columnæ breviter cupulatæ, rarius elongatæ, stipitatæ, loculis parallelis. Ovarium sessile. Cotyledones bifidæ.

* *Stamina 20, omnia antherifera subuniseriata.*

Genera:—13. Ruizia, *Cav.*; 14. Astiria, *Lindl.*

** *Stamina per 2–3 rarius solitaria cum staminodiis 5 alternantia.*

Genera:—15. Dombeya, *Cav.* (*Assonia*, Cav.; *Xeropetalum*, Del.; *Astrapæa*, Lindl.; *Hilsenbergia*, Boj.); 16. Trochetia, *DC.*; 17. Pentapetes, *Linn.* (*Eriorhaphe*, Miq.); 18. Melhania, *Forsk.* (*Brotera*, Cav.; *Pentaglottis*, Wall.; *Cardiostegia*, Presl; *Vialia*, Vis.).

Tribus V. HERMANNIEÆ. Flores hermaphroditi. Petala 5, marcescentia, plana. Stamina 5, basi breviter, rarius in columnam coalita. Staminodia 0 v. minute dentiformia. Cotyledones integræ.

* *Ovarii loculi ∞-ovulati. Semina reniformia, embryone curvato.*

Genera:—19. Hermannia, *Linn.* (*Trichanthera*, Ehrenb.); 20. Mahernia, *Linn.*

** *Ovarii loculi 2-ovulati. Semina obovoidea v. ellipsoidea, embryone recto.*

Genera:—21. Physodium, *Presl*; 22. Melochia, *Linn.* (*Riedleia*, Vent.; *Mougeotia*, H. B. et K.; *Anamorpha*, Karst. et Tri.; *Physocodon*, Turczan.; *Lochemia*, Arn.; *Altheria*, Thou.;

*Visenia*, Houtt.; *Aleurodendron*, Reinw.; *Glossospermum*, Wall.); 23. Dicarpidium, *F. Müll.*; 24. Waltheria, *Linn.* (*Asteropus*, Spreng.).

Tribus VI. BUETTNERIEÆ. Flores hermaphroditi. Petala 5, basi concava, v. in cucullam unguiculatam dilatata, apice acuminata, ligulata, v. rarius nuda. Antheræ 5–15, rarius ∞, ad sinus urceolæ v. cupulæ dentatæ v. lobatæ per 1–3, rarius per 4–5, sessiles v. stipitatæ.

* *Antheræ inter staminodia* 2–∞.

Genera:—25. Glossostemon, *Desf.*; 26. Abroma, *Jacq.*; 27. Theobroma, *Linn.*; 28. Herrania, *Goud.*; 29. Guazuma, *Plum.* (*Bubroma*, Schreb.; *Diuroglossum*, Turczan.).

** *Antheræ inter staminodia solitariæ, nunc triloculares.*

Genera:—30. Ayenia, *Linn.* (*Cybiostigma*, Turczan.); 31. Buettneria, *Linn.* (*Pentaceros*, G. F. Mey.); 32. Rulingia, *R. Br.* (*Achilleopsis*, Turczan.); 33. Commersonia, *Forst.* (*Medusa*, Lour.).

Tribus VII. LASIOPETALEÆ. Flores hermaphroditi. Petala 0 v. squamæformia. Stamina basi leviter connata, 5 antherifera sepalis alterna, sterilia totidem v. pauciora v. 0.

* *Antheræ 2-rimosæ. Carpella matura distincta v. solitaria.*

Genera:—34. Seringia, *Gay*; 35. Keraudrenia, *Gay*.

** *Antheræ 2-rimosæ. Capsula loculicide 3–5-valvis.*

Genera:—36. Thomasia, *Gay* (*Leucothamnus*, Lindl.; *Rhynchostemon*, Steetz); 37. Hannafordia, *F. Müll.*; 38. Guichenotia, *Gay*.

*** *Antheræ 2-porosæ. Capsula loculicide 3–5-valvis.*

Genera:—39. Sarotes, *Lindl.* (*Ditomostrophe*, Turczan.); 40. Lasiopetalum, *Sm.* (*Corethrostyles*, Endl.; *Asterochiton*, Turczan.); 41. Lysiosepalum, *F. Müll.*

### STERCULIA, *Linn.*

This large genus presents considerable diversity in foliage, in the size, shape, and colour of the calyx, in the size, shape, consistence, and degree of dehiscence of the carpels, &c., and it is upon these characters chiefly that Schott (Meletemata, pp. 32 & 33) proposed the dividing it into thirteen distinct genera. Endlicher, however, considering them to be of minor importance, in his 'Genera Plantarum' reunited them all as sections of *Sterculia*, with the ex-

ception of *Pterygota*, characterized by its winged seeds. Brown has since (Pl. Jav. Rar. p. 224), with his usual perspicuity, pointed out the more important characters to be derived from the arrangement of the anthers and the structure of the seed. He reunites many of Schott's genera with *Sterculia*, but still admits ten distinct ones, including two not mentioned by Schott. Some of these are monotypic, and founded on the position of the radicle with relation to the hilum—next to it, at the opposite end, or between the two. Important, however, as similar characters are in most cases, they can yet be regarded only as artificially sectional when separating single species not otherwise distinct from the main group. In the case of *Firmiana*, the two species proposed to be generically united, as having in common the intermediate position of the radicle, are in habit and in their calyx as different from each other as any two species of the whole group. But we have no hesitation in adopting as a good genus the African *Cola* (including *Courtenia*); for there are several species at once distinguished from *Sterculia* by their anthers adnate in a single ring, and by their want of albumen, accompanied by other minor characters. *Courtenia*, with divaricate instead of parallel anther-cells, appears better considered as a section than as a genus; for neither here, nor in other Sterculiaceous genera where the same diversity occurs, does it entail any other tangible differences. *Tetradia*, Br., must also be provisionally admitted; for the fruit and seed are as yet unknown, and may present characters corroborative of those derived from the flower. But we would restore to *Sterculia*, as mere sections, *Firmiana*, *Brachychiton*, *Pterygota*, *Hildegardia*, *Scaphium*, and *Pterocymbium*; including in *Brachychiton* the *Delabechea* of Lindley, in which we find the radicle next the hilum as stated by Brown, not remote from it as described by Lindley.

### TARRIETIA, *Blume*.

This genus, allied in most respects to *Sterculia*, has the indumentum and inflorescence of *Heritiera*, with much smaller flowers and very peculiar samaroid carpels. It includes an Australian species published by F. Müller under the name of *Argyrodendron*. The leaves are digitately compound, with five leaflets according to Blume's figure and description, three only in the specimens distributed by Miquel as Blume's species, as well as in the Australian species.

### MYRODIA, *Schreb*.

We have already stated our reasons for excluding from *Myrodia*, and referring to Bombaceæ, the *M. longiflora*, forming the genus *Quararibea*, Aubl., as well as the species I had provisionally named in Spruce's plants *M. breviflora*, but which I have above described under the name of *Scleronema*. On the other hand, Endlicher proves to have been correct in his suggestion that *Lexarza*, Llave, belongs to *Myrodia*. Specimens agreeing in every respect with that author's description of his *L. funebris* are in the Hookerian herbarium, from Oaxaca, *Andrieux*, n. 512, from Papantla, *Liebmann*, and from near Sonsonate in San Salvador, *Sutton Hayes*. The flowers are considerably larger than in *M. turbinata*, from which it may be thus distinguished:—

*M. funebris*, foliis subtus ad axillas venarum tomentoso-barbatis, pedicellis calyce brevioribus 2–3-bracteatis, antheris 25–30.—*Lexarza funebris*, Llave in Llave et Lex. Nov. Veg. Descr. fasc. ii. p. 7.

### DOMBEYA, *Cav.*

In a paper of Dr. Planchon's in the 6th vol. of the 'Flore des Serres' (which we have been unable to procure, and which is therefore only known to us from the abstract in Walpers' 'Annales,' iv. p. 325), the genus *Dombeya* is well characterized and divided into sections; and *Xeropetalum*, Delile, is correctly included. We would also agree with him in considering the *Astrapæa viscosa*, Bot. Mag., and its allies as a section only of *Dombeya*, in which the staminal tube exceeds the ovary; but, in so doing, it does not appear possible to exclude *Hilsenbergia*, Boj., and *Astrapæa*, Lindl., which only differ in the staminal tube being still longer. Nor can we reject *Assonia*, Cav., which only differs slightly in the bracts from the smaller-flowered, short-columned species. Thus constituted, *Dombeya* forms a well-marked and natural genus of about 24 species, only separated, however, from *Ruizia* and *Astiria* by the sterile stamens or lobes of the column.

### TROCHETIA, *DC.*

This genus, extended to its proper limits, becomes a very natural one, differing from *Dombeya* in its inflorescence and the shape of its flowers, in the more coriaceous calyx, and more numerous ovules in each cell of the ovary; from *Pentapetes* in its arborescent habit, in the calyx, and in the style more divided at the top; from *Melhania*, into which some species have been hitherto placed, it is still more distinct in habit and calyx, and in the anthers always 2, 3 or 4 between each two sterile stamens, instead of one only as in *Melhania*. The species we have seen are *T. grandiflora*, Lindl., with the anthers in fours between each two sterile stamens; *T. uniflora*, DC., and *T. parviflora*, Boj., with the anthers in threes; and *T. decanthera* (*Melhania decanthera*, DC.), *T. laurifolia* (*Melhania laurifolia*, Boj.), *T. erythroxylon* (*Melhania erythroxylon*, Ait.), and *T. melanoxylon* (*Melhania melanoxylon*, Ait.), all with two anthers only between each two sterile ones. All the species are from Mauritius or Madagascar, except the two last, which are from St. Helena—or rather *were*, for both are now said to be extinct. This distribution of so marked a genus over these distant islands, without any traces of it (as far as known) in the intermediate continent, may suggest some curious speculations as to the gradual extinction of ancient floras. These two St. Helena species are indeed described as pentandrous only; but I have certainly found the anthers in pairs in all the specimens I have seen, although with their short filaments united: that is, however, partially the case in some of the Mauritius species.

### PENTAPETES, *Linn.*

This genus, occasionally made the receptacle of several doubtful Dombeyeæ, is now reduced to the single *P. phœnicea*, Linn.; for the *P. angustifolia*, Bl., is generally admitted to be a mere variety. Miquel has indeed distinguished it as a genus under the name of *Eriorhaphe*; but on carefully studying his description, I find every part of it (including the nerve-like plumose placenta, whence he derived his name) applicable to the common *P. phœnicea*, except, perhaps, the number of anthers, 10 only instead of 15—that is, two instead of three between each two sterile stamens. From having observed, however, that one or two anthers are wanting in some flowers of our specimens, I should suspect that the number 10 was accidental in the flower examined by Miquel.

### MELHANIA, *Forsk.*

*Melhania*, deprived of the arborescent species referred as above to *Trochetia*, and including *Brotera*, Cav., *Pentaglottis*, Wall., *Cardiostegia*, Presl, and *Vialia*, Vis., becomes a very natural and well-defined genus, distinguished from all other Dombeyeæ by the anthers solitary between each two sterile stamens, and readily known by their habit approaching that of *Serræa* among Malvaceæ rather more than that of *Hermannia*, to which it has been compared. It includes about sixteen species, dispersed over Africa and the warmer, drier regions of Southern Asia and Northern Australia.

## MELOCHIA, *Linn.*

We follow A. Gray and others in referring to this genus, as sections, not only *Riedleia*, Vent., including *Mougeotia*, H.B. et K., *Lochemia*, Arn., and *Altheria*, Thou., but also *Visenia*, Houtt., to which belong *Aleurodendron*, Reinw., and *Glossospermum*, Wall. As to *Physodium*, Presl, from the fragmentary specimens of two Mexican species in the Hookerian herbarium, it appears to have a very different habit, and perhaps the very large Physalis-like mature calyx may suffice to keep it distinct, but it requires to be better known before the point can be decided. The recently proposed genus *Anamorpha*, Karst. et Tri., and the two species of *Physocodon*, Turczan., are all founded on the *Melochia* (*Mougeotia*) *inflata*.

## GLOSSOSTEMON, *Desf.*

This is a Persian plant, not very common in our herbaria, but interesting in the structure of its andrœcium, as affording perhaps some clue to the explanation of the anomalies observed in the homology of the flowers of Sterculiaceæ with respect to the position of the stamens. We have seen that the staminal column in this Order is usually divided into a definite number of barren or antheriferous teeth or filaments, which is usually some multiple of the sepals or petals. In a very few genera (e. g. *Astiria*, and probably *Assonia*) these filaments, four times as many as the sepals, all bear anthers, and are all apparently in a single row and equidistant—an occasional occurrence in different Orders of various staminal homologies: but in the majority of Sterculiaceæ, the five innermost divisions, *always opposite the sepals*, are without anthers, and take the name of teeth or staminodia, according to their degree of development; and between them, and consequently more or less *alternate with the sepals* or opposite the petals, are 1, 2, or more sessile or stipitate anthers, always turned outwards and lying outside the staminodia in the bud. In a few genera (e. g. *Waltheria* and some *Melochias*) the staminodia almost or even totally disappear, and there remain only 5 stamens, connate in a ring or cup at the base, but each tapering into one anther-bearing filament opposite the petal, instead of alternating with it as is usually the case where the stamens and petals are isomerous. It has been attempted, especially by A. Gray, to explain this anomaly as a case of *dédoublement*; that is to say, by supposing that each stamen with its corresponding petal arises from the splitting of one homological leaf; the whole flower consisting of three whorls only, of five leaves each, the outer one forming the calyx, the next the petals and stamens, and the inner one the carpels. But when we consider that in the whole group of Columniferæ the petals are either perfectly distinct and sometimes distant from the staminal column, or, if they adhere to it near the base, the attachment is superficial only, the vascular systems remaining perfectly distinct, and that even this attachment is wanting in those genera where *dédoublement* is most relied upon, we must have something more than mere conjecture, some strong cases of intermediate structure, to counteract the evidence of our senses, and establish in theory that two totally disconnected organs are, in fact, branches of one organ.

It is well known that the (homological) leaf is very ready to ramify laterally—in its own plane; but, as far as my experience extends, ramification in a direction at right angles to that plane, either by the production of excrescences from either surface, or by anything approaching to a splitting or separation of the two surfaces, is confined to the three following categories:—

1. The production of epidermal excrescences, such as hairs, prickles, &c., never converted into real organs.

2. Prolification, the result of plethora or of some accidental determination of sap to particular points, resulting in abnormal foliaceous appendages, or adventitious roots and buds, which may become independent individuals, but never efficient organs of the mother-plant.

3. The production of petiolar glands, which alone can have any bearing on our present case. These glands, which I have called petiolar to distinguish them from several other bodies bearing usually the same name of glands, are not, however, strictly confined to the petiole. In most stem-leaves where they occur, there are two or a single one of them at or near the summit of the petiole or the base of the limb; but they are sometimes more numerous, irregularly placed on the petiole, rarely on some of the principal veins or in their axils, but not unfrequently on the margin of the leaf at the extremity of the principal veins; and they are usually disk-shaped, concave, or cup-shaped. In bracts they sometimes attain a size very large in proportion to the rest of the bract. In the petal they are very apt to assume the form of an entire or two-lobed scale at the base of the lamina or on the claw, sometimes as large as the rest of the petal, sometimes reduced to a mere concavity in the petal, or to a slight discoloration or alteration in the texture of its surface. In the stamen, according to

views I stated many years ago (Hook. Kew Journ. Bot. i. 358), and of which I have seen no refutation, these glands are represented by the anther-cells, the petiole by the filament and connective, and the lamina either totally abortive or represented by petaloid appendages to the connective. Keeping this theory in view, we may well conceive that a *dédoublement* of the petal may produce the inner petaloid scale of some Sapindaceæ, Violaceæ, Bixaceæ, &c., or the fimbriate scales in the tube of *Cuscuta* and other gamopetalous flowers, or the corona of *Passiflora*, the cup-shaped nectary of *Narcissus*, &c.; or, again, that a *dédoublement* of the stamens may result in the staminal corona of Asclepiadeæ when arising from the gynostegium. But that there is anything of the kind in Sterculiaceæ is, I think, fully disproved by the Buettnerieæ, where this supposed formation has been most relied upon; for here the petiolar gland of the petal-leaf forms the apex of the hood, connivent over or adhering to the staminal column, and is perfectly distinct in origin and position from the anther which it so curiously encloses*.

How then are we to account for the disturbance occurring in Sterculiaceæ of the usual alternation in the staminal whorls? I find that on soaking the andrœcium in several genera, and more especially in *Glossostemon*, it separates very readily into five bodies (adelphia), normally alternating with the petals, each one ending in a point or appendage (the teeth, barren lobes, or staminodia of the staminal column), and bearing the anthers on its margin on each side of the central point. Might we not consider each such body or fascicle of stamens as one staminal leaf, with branched veins, the central vein bearing no anther (or altered gland), the lateral branches each terminating in an anther (or altered gland) corresponding to the marginal glands on the stem-leaves of several species of *Homalium*, *Ranara*, Euphorbiaceæ, &c.? Where the number of anthers between each two staminodia is an even one (2, 4, 6 or 8), the staminal leaf has the same number of anthers on each side of the central nerve; where it is an odd one (1, 3, or 5), there is one more on one side than on the other,—a circumstance readily explained by the great tendency to obliquity in the parts of the floral whorls, where the æstivation is so strongly contorted. In confirmation of this view I may also observe, that in *Melhania* I never find the anther-bearing stamen exactly opposite the centre of the petals, but somewhere between the margin and the midrib*.

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* The supposed lateral *dédoublement* in the staminal leaves of the inner whorl in Cruciferæ is, to my mind, equally mythical; and I hope, on an early occasion, to lay before the Society my reasons for coming to this conclusion.

If the supposition, or as some would say conjecture, that the andrœcium of most Sterculiaceæ consists of five leaves, each bearing 1, 2, or more marginal anthers, be admitted, we must, in order to account for the internal position of the terminal point and for the extrorse direction of the anthers, further suppose that the edges of the leaf are slightly revolute in æstivation, not involute or inflexed as is usually the case with staminal leaves when not valvate or open. Similar exceptions to the ordinary æstivation occur, however, in other instances. Ordinary extrorse anthers do not indeed necessarily involve such an explanation, for petiolar glands may occur on the back as well as on the front of the leaf; but in many Laurineæ for instance, where the stamens are in three or four series, there is evidently a diversity in their æstivation, those of the outer series being involute, and the inner ones revolute.

### ABROMA, *Jacq.*

The so-called strophiola in this genus is not an expansion of the hilum of the seed, nor yet of each separate funiculus, but a projection of the general placenta upon which the seeds are separately attached.

*A. nitida*, Pœpp. et Endl., belongs to *Herrania*, as well as the *A. Mariæ*, Mart., already referred to that genus.

### GUAZUMA, *Plum.*

The genus *Diuroglossum*, Turczan., described in the Moscow Bulletin, 1852, is nothing but the common *Guazuma tomentosa*.

### AYENIA, *Linn.*

In this genus and in a few species of the closely allied *Buettneria*, the anthers, solitary between each two sterile stamina or teeth of the andrœcium, have three parallel cells instead of two. This seems to indicate that the anther is compound, and may admit of two solutions. Grisebach suggests that the three cells may represent the three anthers of *Guazuma*, which have divaricate but distinct cells, but that here, by their closer combination, these divaricate cells have become completely confluent, without any trace of a transverse separation or contraction; and that we have thus the one-celled anthers of Malvaceæ, thereby doing away with the chief distinctive character of the two orders. I have, however, in vain searched for any species, either of *Ayenia* or *Guazuma*, showing any intermediate state between the ordinary anthers of the two genera; and in all other respects the two genera, though not inappropriately following each other in the linear series, have wide constitutional differences, in the calyx, the petals, the number of ovules, the styles, and, above all, in the embryo. On the other hand, in the great majority of *Buettnerias* the anthers have two parallel cells, which have as completely the appearance of belonging to one anther only as those of *Rulingia*; and when the third cell is present, might it not be considered as the half of an anther belonging to the adjoining staminal leaf, under the theory above suggested in explanation of the andrœcium of Sterculiaceæ? The three-celled anthers of *Ayenia* would then be explained as consisting of one complete two-celled, and one dimidiate anther.

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* Whilst suggesting the above explanation of the abnormal position of the stamens in Sterculiaceæ, I am well aware that the fact of the outer stamens being opposite the petals in Geraniaceæ and their allies must be accounted for on other grounds.

*Cybiostigma* of Turczaninow is founded on the common *Ayenia magna*, L., and a closely allied species, and has nothing to separate it generically from the other species.

### RULINGIA, *R. Br.*

*Achilleopsis*, Turczan. (Walp. Ann. ii. 165), does not appear to be sufficiently distinct from *Rulingia*. I do not find the stamens quite free from the base, although much more shortly united than in most *Rulingias*.

### LASIOPETALEÆ.

In this tribe, entirely Australian, where the petals are wanting or rudimentary, the andrœcium may be formed on a somewhat different principle from that of the other Sterculiaceæ. The stamens of the outer whorl opposite the sepals are reduced to barren filaments or, like the petals, entirely deficient; and the five anther-bearing stamens, alternate with the sepals as in other pentandrous Sterculiaceæ, may, however, really belong to the inner staminal whorl.

The genera of this tribe have probably been too much multiplied on characters of very little importance. Even the difference in the dehiscence of the anthers, by short pores or long slits, is not always clearly marked; and although we have still availed ourselves of it as distinguishing considerable groups, these are not so natural as could have been wished. The two first genera, *Seringia* and *Keraudrenia*, are well separated from all the others by their ripe carpels distinct or solitary, not forming a loculicidal capsule; and the two are equally well distinguished by the seeds ellipsoid with a straight embryo in *Seringia*, reniform with a curved embryo in *Keraudrenia*. The calyx and habit of the former also approach those of *Commersonia*, whilst those of *Keraudrenia* are nearer to *Thomasia* and *Lasiopetalum*. But *Seringia* must be understood as originally limited by Gay, and *S. nephrosperma*, F. Müll., transferred to *Keraudrenia*. Of the remaining six genera which we have adopted, three (*Thomasia*, *Guichenotia*, and *Hannafordia*) have the anthers opening in pores; and in three (*Sarotes*, *Lasiopetalum*, and *Lysiosepalum*) they open in slits. *Guichenotia*, *Hannafordia*, and *Sarotes* are distinguished by their calyx marked when enlarged by 3 or 5 prominent ribs on each sepal, and *Hannafordia* by the lanceolate petals much more developed than in other Lasiopetaleæ; and lastly, *Lysiosepalum*, F. Müll., which I have not seen, is said to be well marked by the sepals entirely free from the base: but all these must be admitted to be rather artificial than natural distinctions.

As to the other proposed genera, we would reduce *Leucothamnus*, Lindl., and *Rhynchostemon*, Steetz, to *Thomasia*; *Ditomostrophe*, Turczan., to *Sarotes*; and *Corethrostyles*, Endl., and *Asterochiton*, Turczan., to *Lasiopetalum*.

The apparently ternately verticillate leaves of *Guichenotia*, *Sarotes*, and some *Lasiopetala*, in which one leaf is always larger than the two others, appear to correspond to the leaf with two leaf-like stipules of other *Lasiopetala* and of *Thomasia*. In a few *Lasiopetala* the leaves appear to be really opposite, which is, I believe, the only instance in the whole Order of Sterculiaceæ.

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During the ten months which have elapsed since this paper was sent in to the Society, fresh materials have accumulated, which have enabled me to make some slight improvements in the arrangement of a few genera, as well as a few additions, but not so as to interfere with the observations above given. The *Kydia axillaris* of Thwaites, now that the flower is known, proves to be a new genus allied to *Julostyles*, to which must also be referred *K. jujubifolia*, Griff. As Mr. Thwaites did not send any name with his notes, we have given it that of *Dicellostyles*, in allusion to its forked style. A Mauritius specimen, long overlooked among the unnamed ones in the Hookerian herbarium, can only be referred to a new genus, allied on the one hand to *Dombeya* and on the other to *Trochetia*, to which we have given the name of *Cheirolæna.* And amongst Griffith's unnamed specimens we have also a new genus of Durioneæ, allied to *Boschia* and *Neesia*, remarkable for its very small flowers with a depressed circular calyx marked by five cavities at the base of its lobes, with corresponding protuberances outside, and which have suggested the name of *Cœlostegia.* As the part of our 'Genera Plantarum' comprising these Orders is now in the press, it would be superfluous to repeat here the characters of these new genera.

With reference to the observations above given on the homology of the stamens of Buettnerieæ, I would add that Professor Oliver, whose opinions on similar questions must always have great weight, in a paper lately read before the Society, objects to my comparison of the anther of the staminal leaf with the petiolar glands of the leaf properly so called. I freely admit that plausible arguments may be brought forward against my views; but upon a full reconsideration of the subject, I confess myself still further inclined to believe that the explanation I have suggested is likely to prove correct.

I have also to add to my former paper on Tiliaceæ, that, with reference to *Antholoma*, a cursory inspection of specimens during my visit to Paris last autumn, and the examination of a bud and flower kindly sent to me by M. Brongniart, have fully confirmed Dr. Planchon's suggestion that the genus is Tiliaceous—not far from *Elæocarpus.* It is indeed closely allied to *Sloanea*, differing chiefly in the petals united into a tubular, almost conical corolla. I understand that M. Baillon has fully described the plant in a number of his 'Recueil d'Observations' which has not yet reached us.

March 1862.

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## West African Tropical Orchids.

By Dr. Lindley, F.R.S., F.L.S., &c.

[Read November 7, 1861.]

Most of the plants included in the following succinct enumeration have been obtained in the Expedition to the West Coast of Africa, under the command of Dr. Baikie, R.N. The larger part resulted from the investigation of the late Mr. Barter, a most zealous and skilful collector, who unfortunately fell a victim to his exertions. The remainder have been sent home by Mr. Gustav Mann, who may be fairly pronounced to be second to no one. For the opportunity of examining and describing them, I am indebted to Sir William Hooker.

Till the present time, the species of the Order known to exist in the region over which these collections have extended, were little known; the colony of Sierra Leone having supplied the greater proportion of the 19 previously described. Those now enumerated inhabit the middle and lower course of the Niger River, the country extending from Lagos to the Cameroons, with several from Fernando Po, where, however, *Ansellia africana*, the only species before known from that island, was not seen by Mr. Mann. In all, I have examined 67 species, of which 48 were previously undescribed.

Of those bearing a well-marked resemblance to other portions of the African Flora, the principal part resemble Cape species. These are *Polystachya alpina*, near *P. Ottoniana*; *Penthea Pumilio*, a striking addition to a small Cape genus; *Angræcum arcuatum*, identical with the plant from Albany; and *Cymbidium adenoglossum*, which resembles the *C. tabulare* of Table Mountain.

Others must be compared with Eastern Africa: thus, *Amphorchis occidentalis* is the second species of a genus inhabiting the Isles of France and Bourbon; *Corymbis disticha* is the same as the plant from the same islands; *Calanthe corymbosa* is very near *C. sylvatica* of the Isle of France; *Habenaria prœalta* is undistinguishable from the Bourbon species; and *Bolbophyllum lupulinum* has all the appearance of *B. occultum* from the Mauritius and Bourbon, although the structure of the flowers is widely different; finally, there is a new *Notiophrys*, near *N. occulta*, from the same islands. To these special resemblances must be added the generic similarity among many species of *Bolbophyllum*, *Polystachya*, and *Angræcum*, in Eastern and Western Africa: the collections containing 14 species of the first, the same number of the third, and 9 of the second.

Perhaps the most striking geographical fact consists in the presence of the Asiatic *Epipogum nutans* at Ambas Bay, a place a little to the north of the embouchure of the Cameroons River.

It is worthy of remark in conclusion that there is little resemblance between the species now described and those of Abyssinia; there is no *Satyrium*, no *Peristylus*, no *Pterygodium*; and the species of *Habenaria* are quite dissimilar. It is only in the case of *Eulophia guineensis*, the *Saccolabium abyssinicum* of Achille Richard, that the identity of a West African and Abyssinian plant has been ascertained.

### LIPARIS, *Richard.*

1. Sp.? in fruit only.

"On Mangroves, R. Nun." (2122) *Barter.*

2. Sp.? no flowers.

"Terrestrial, in a swamp. Flowers deep red. Lagos." (2202) *Barter.*

3. L. GUINEENSIS? *Lindl. in Bot. Reg.* vol. xx. t. 1671.

"Flowers small, purple. Prince's Island." (1980) *Barter.*

The flowers are very young; but the plant would certainly be referred to *L. guineensis* were they green instead of purple.

4. Sp.? no flowers.

"On rocks. Prince's Island." (2029) *Barter.*

### BOLBOPHYLLUM, *Thouars.*

§ *Ptiloglossum*; labello elastice articulato, plumoso.

1. B. CALAMARIUM, *Lindl. in Bot. Reg.* 1843, *Misc.* 109; *Bot. Mag.* t. 4088.

"Flowers chocolate. Labellum fringed with long hairs. Town of Nupe." (1482) *Barter.*

2. B. RHIZOPHORÆ; pseudobulbis ovatis diphyllis, foliis oblongis conduplicatis obtusis, spicis multifloris pendulis, bracteis subrotundo-ovatis reflexis margine membranaceis, rachi floribusque scabris, sepalo dorsali lineari lateralibus intus pubescentibus subrotundis cuspidatis multo longiore, petalis linearibus angustissimis glabris apice setaceis, labello lineari intus villoso sub apice mucronulato.

"On Mangroves. Flowers uniform deep purple. R. Nun." (2118) *Barter.*

A very distinct species, with the small flowers and angular filiform rachis covered with a purple rough fur. The bracts are quite smooth.

3. B. DISTANS; pseudobulbis quadrangulis brevibus monophyllis, foliis loratis basi angustatis obtusis spica disticha longioribus, bracteis glumaceis distantibus, sepalis petalisque setaceo-acuminatis, labello a basi concava carinata longissime setaceo villosissimo.

"Epiphyte. Banks of the R. Nun, Sept. 1860." (525) *Mann.*

Leaves about 6 inches long. Scape from 2 to 4 inches long, with about two tight vaginæ. Hairs of the lip apparently violet.

4. B. COCHLEATUM; pseudobulbis angustis teretibus diphyllis, foliis angustis obtusis, scapo plurivaginato paulo breviore, spica densa disticha bracteis cochleatis imbricatis, sepalis carnosis subæqualibus, petalis ovatis carnosis columnæ æqualibus, labello linguiformi supra carinato sepalis breviore, columnæ dentibus erectis obtusis postice emarginatis.

"Epiphyte. Fernando Po, at 4000 feet, Dec. 1860." (643) *Mann.*

The whole inflorescence seems to be purple, and is not unlike that of *Pholidota imbricata*. The lip is unusually small in this section of the genus.

5. B. TENUICAULE; rhizomate filiformi reptante, pseudobulbis distantibus tenuibus diphyllis, foliis linearibus emarginatis, scapo filiformi plurivaginato, spica laxa bracteis glumaceis obtusis haud imbricatis, sepalis petalisque acutis æqualibus, his linearibus acuminatis, labello oblongo concavo obtuso, columna biseta.

"Epiphyte. Fernando Po, at 5000 feet, Dec. 1860." (648) *Mann.*

Much like a small specimen of the next, but differing in the characters assigned to it.

6. B. GRAVIDUM; pseudobulbis ovatis angulatis diphyllis, foliis linearibus acutiusculis, scapo multivaginato longiore, spica oblonga imbricata, bracteis oblongis cymbiformibus, sepalis subæqualibus carnosis canaliculatis acuminatis reflexis, petalis oblongis, labello linguiformi obtuso, columna antice ventricosa appendicibus 2 antice repandis.

"Epiphyte. Fernando Po, at 3000 feet, Dec. 1860." (650) *Mann.*

Resembles *B. cochleatum*, but its spike stands high above the leaves, and the petals and column are quite different; the lip too is larger in proportion.

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7. B. LUPULINUM; pseudobulbis ancipitibus oblongis diphyllis, foliis oblongis obtusis basi angustatis, scapo laxe vaginato pseudobulbo breviore, spica oblonga multiflora bracteis maximis distichis cymbiformibus dense imbricatis nigro furfuraceis, floribus intra bracteas absconditis parce scabridis, sepalis ovatis carnosis, petalis nanis filiformibus, labello oblongo carnoso margine tenui serrato apice calloso obtuso refracto, columna mutica, anthera apice producta incrassata, polliniis 2 connatis.

"Epiphyte. Flowers dark purple. Ambas Bay, Febr. 1861." (783) *Mann.*

In general appearance much like Du Petit Thouars' figure of *Bolbophyllum occultum*, a plant of which I have seen no specimen. They are, however, entirely different in the minute parts of fructification: *B. occultum* having the feathery lip of a Ptiloglot and the two setæ usual in *Bolbophyllum*, while in the species now described the lip is a solid fleshy plate, and the column has no setæ; moreover it has a reflexed white glandular point to the purple lip, an anther with a great fleshy apex, and a pair of oblong connate pollen-masses, all characters at variance with *B. occultum*. It is still more like *B. tetragonum* in structure, though wholly different in habit.

The pseudobulbs are thin, 3 inches long, with an imperfect third edge on one side; and the leaves 9 inches long by 1½ inch wide.

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8. B. ELAIDUM; repens dense cæspitosum, pseudobulbis depressis diphyllis, pedunculo setaceo unifloro foliis lineari-lanceolatis multo longiore, floribus sessilibus bibracteatis, sepalis glabris petalisque minoribus apice setaceis, labello conduplicato lineari obtuso glabro basi dilatato.

"Flowers greenish white. On oil Palms, Brass." (1841, and 73) *Barter.*

There are two unequal diaphanous acuminate bracts beneath each flower, of which the lower is ovate, the upper linear.

9. B. INTERTEXTUM; rhizomate ramosissimo intricato, pseudobulbis ovatis monophyllis, foliis oblongis ovalibusque apiculatis, scapo setaceo multo longiore 2–3-floro, bracteis angustis recurvis ovario longioribus, sepalis membranaceis setaceo-acuminatis, petalis oblongis emarginatis, labello ovato obtuso carnoso sulcato glabro, columna bidentata.

"Epiphyte, green. Banks of the Nun, Sept. 1860." (527) *Mann.*

Much like the last; but the flowers are not solitary, the leaves are not in pairs, the petals are not setaceous, nor is the lip attenuated.

10. B. APETALUM; pseudobulbis angulatis diphyllis foliis æqualibus, scapis setaceis foliis longioribus, spica laxa pauciflora, sepalis carnosis angustis galeatis, petalis obsoletis, labello longo angusto cuneato cucullato scabriusculo apice glabro reflexo carnoso, columna utrinque dilatata carnosa.

"Bagroo River, 1861," *Mann*; and probably "on oil Palms, Brass." (72) *Barter*, without flowers.

This singular little species has flowers like miniatures of *Aconitum Lycoctonum.* For petals there are only two minute rudiments, the lip resembles that of a Polystachya, and the column has two deep fleshy purplish cheeks.

11. B. MICROPETALUM; pseudobulbis angulatis diphyllis foliis linearibus emarginatis obtusis æqualibus, scapo setaceo foliis longiore, spica pauciflora, bracteis brevibus cucullatis, floribus subrotundis, sepalis acutis, petalis setaceis obsoletis, labello cuneato cucullato antice recurvo, columna membranacea brachiis truncatis denticulatis.

"Epiphyte. Fernando Po, at 4000 feet, Dec. 1860." (644) *Mann.*

In general habit like *B. intertextum*; two minute bristles are all that represent petals; the arms of the membranous column are as if cut off by a knife. The little flowers appear to be yellow. Seems to be related to *Bolbophyllum nutans* of Du Petit Thouars.

12. B. FALCIPETALUM; pseudobulbis ovalibus ancipitibus diphyllis, foliis linearibus emarginatis, scapo longiore scabriusculo ad basin fere florido, bracteis ovatis semiamplexicaulibus refractis, sepalis acutis dorsali latiore, petalis columnæ pedem decurrentibus linearibus falcatis, labello obtuse hastato basi concavo 3-lineato, columnæ angulis incurvis.

"Epiphyte, yellow. Banks of the Nun, Sept. 1860." (526) *Mann.*

The narrow sickle-shaped petals curve forwards over the lip, like a pair of sharp horns.

13. B. PAVIMENTATUM; pseudobulbis densissimis subrotundo-oblongis compressis monophyllis, foliis oblongis planis pedicellatis, scapo foliis longiore filiformi erecto arcte 4-vaginato, spica densa, floribus carnosis glabris bracteis obtusis longioribus, sepalis ovatis acuminatis obtusis, petalis ovatis retusis, labello brevi carnoso tomentoso obtuse acuminato revoluto, columna biseta.

"Epiphyte. Calyx green, corolla purple. Banks of the Nun, Sept. 1860." (519) *Mann.*

The ground is closely paved with the pseudobulbs of this species, which may be compared with such as *cupreum* or *recurvum*.

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14. B. COMATUM; pseudobulbis ovatis angulatis monophyllis, foliis papyraceis spathulatis acuminatis, scapo pseudobulbis duplo longiore laxe vaginato, spica oblonga densissima villosissima, sepalis acuminatis, petalis subrhombeis acutis labelloque oblongo obtuso canaliculato scabridis, columnæ brachiis erectis linearibus retusis.

"Epiphyte. Fernando Po, at 2000 feet, Dec. 1860." (642) *Mann.*

A very singular species, little like any other. The heads of flowers are from an inch to 1¼ inch long, so entangled with hairs as to resemble a mass of wool.

## MEGACLINIUM, *Lindley.*

1. M. OXYPTERUM, *Lindl. in Bot. Reg.* 1839, *Misc.* 10.

"Flowers yellow. Prince's Island." (2026) *Barter.*

The leaf is broader and more oval than in the cultivated plant.

2. M. PURPURATUM; folio solitario oblongo, rachi angusta obtusa cuspidata crenata, bracteis oblongis apiculatis margine revolutis, sepalis aristatis dorsali fornicato, petalis setaceis, labello ovato-lineari basi denticulato.

"Flowers and whole spike purple. Brass." (1854) *Barter.*

## CALANTHE, *R. Brown.*

1. C. CORYMBOSA (§ *Eucalanthe B.*); foliis latis 5-nerviis acuminatis basi longe angustatis subtus pilosiusculis, corymbo denso tomentoso, bracteis lineari-lanceolatis ovariis longioribus, labello cuneato bilobo apiculo interjecto apice utrinque truncato dentato basi verrucoso dente parvo porrecto utrinque, calcare filiformi arcuato.

"Herbaceous, 1½ foot high. Corolla white and purple; at 5000 feet, on Fernando Po, Dec. 1860." (392) *Mann.*

An ally of *C. sylvatica* and *natalensis*, from which its dense corymbose inflorescence distinguishes it, exclusive of other important marks. The leaves are 4 inches broad.

## POLYSTACHYA, *Hooker.*

1. P. ENSIFOLIA; caule flexuoso compresso, foliis ensiformibus supremo spica simplici longiore, bracteis subulatis, floribus glabris, sepalis lateralibus triangulis carinatis, labello oblongo lævi hastato: lobis basilaribus linearibus acutis nanis.

"Flowers yellow." Prince's Island (1986) *Barter.*

This has much the habit of *Epidendrum armeniacum* (Pöppig's *Encyclia macrostachya*), except that the spike is shorter and thinner. I do not find the usual pulverulent surface upon the face of the labellum.

2. P. BIFIDA; caule stricto gracili, foliis ensiformibus acute bifidis, racemo simplici laxo glabro paucifloro, sepalis obtusis, petalis linearibus, labello sessili carnoso angusto obtuse trifido concavo pulvinare basilari oblongo apice unituberculato.

"Epiphyte, 4000 feet, Fernando Po, Dec. 1860." (649) *Mann.*

This too has the habit of *Epidendrum armeniacum*. From *P. ensifolia* it differs in its much narrower sharply bifid leaves, its loose raceme, blunt sepals, and wholly dissimilar lip, the cushion of which is furnished at the point with a distinct downy tubercle.

3. P. LAXIFLORA; foliis oblongis basi angustatis, panicula patentissima racemosa pubescente, sepalis pubescentibus petalisque linearibus acutis, labello brevi unguiculato lamina rotunda cordata acute tridentata pulvinare lineari secus unguem.

"Epiphyte, a foot high, Fernando Po, June 1860." (437) *Mann.*—"Flowers pale yellow. On Mangroves. R. Nun." (2126) *Barter.*

This is one of the larger species, with spreading panicles of racemose flowers, in which respect it greatly resembles *P. puberula*. Its flowers are more than twice as large, and the lip has a long narrow unguis, to the middle of which the cushion is confined; the lamina of the lip too is nearly circular, with three short sharp teeth. The fruit is $1\frac{1}{2}''$ long, clavate, with projecting ribs. It flowered in May 1861 in the Royal Botanic Garden, Kew.

4. **P. odorata**; foliis oblongo-lanceolatis membranaceis, spica paniculata pubescente ramulosa, bracteis subulatis, sepalis setaceo-apiculatis, labello cuneato trilobo unguiculato: lobis lateralibus falcatis obtusis intermedio rotundato, ungue carinato farinaceo.
"Flowers white, fragrant." Onitscha. (1483) *Barter.*—Fernando Po, June 1860. (436) *Mann.*

Differs from *P. ramulosa* in its larger downy flowers and in the form of the lip; from *P. puberula* also in the form of the lip; and from both in having a deep keel in the middle of the unguis.

5. **P. tessellata**; foliis oblongo-lanceolatis pergameneis panicula stricta decomposita glabriuscula gracili ramulosa multo brevioribus, bracteis subulatis, sepalis acutis, labello cuneato unguiculato trilobo: lobis lateralibus falcatis obtusis intermedio subrhombeo emarginato ungue pubescente semicarinato.
"Mouth of the Nun River, left bank, Aug. 1860." (—) *Mann.* Also "from the Cameroons," *Id.*; but no specimen from that locality has been seen by me.

This is much like a very large form of *P. odorata*, and possibly may hereafter prove to be nothing more. It is, however, a much stouter plant, with thicker and blunter leaves, and a tall erect cane-like stem with tier upon tier of fascicles of many-flowered dense spikes; there is little pubescence on the flowers, which are smaller and appear as if tessellated when viewed by transmitted light; the middle lobe of the lip is rather different in form, and the keel in the middle of the unguis is shorter and more undefined.

6. **P. pyramidalis**; foliis lanceolatis acuminatissimis, spica composita pyramidali densissima puberula, bracteis cucullatis acutis, sepalis acutis glabriusculis, petalis linearibus, labello cuneato plano sessili obtuso apiculato basi utrinque unidentato tota facie pulverulenta.
"Epiphyte. Calyx and corolla yellow. Banks of the Nun River, Sept. 1860." (522) *Mann.*

A very striking plant, more than $1\frac{1}{2}$ foot high, with flat firm 3–5-ribbed leaves from 4 to 5 inches long. The spikes are short, dense, from 2 to 5 forming a pyramidal inflorescence.

7. **P. setifera**; foliis oblongis acutis membranaceis supremo elongato spathaceo angustiore, spica subcomposita bracteis setaceis, floribus

pubescentibus, sepalis setaceo-aristatis, labello ovato acuminato membranaceo nudo utrinque unidentato.

"Flowers dull purple." Prince's Island. (1984) *Barter.*

Very distinct in the long setaceous points of the sepals and the thin ovate lip.

8. P.? ALPINA; subacaulis, foliis linearibus obtusis emarginatis, pedunculo hispido unifloro, flore glabro longe pileato, sepalis acutis dorsali concavo, petalis linearibus acutis, labello longe unguiculato rotundato apiculato basi appendice carnoso 6-lobo aucto unguis marginibus inflexis ciliatis.

"Epiphyte, at 6000 feet, Fernando Po, Dec. 1860." (647) *Mann.*

The pollen of this little plant being unknown, it may be doubted whether it belongs to the genus *Polystachya*, especially since it has not the cushion characteristic of all the other certain species, but in its place a remarkably fleshy 6-lobed flat round process. It has, however, the habit of *Polystachya capensis* of Sonder (*P. Ottoniana*, Rchb. f.). I have only seen two specimens, each a few inches high, bearing one dark-red flower, with similarly red carinate bracts.

9. P. ELASTICA; foliis lineari-lanceolatis apice obliquis scapo subæqualibus, spatha membranacea convoluta pedunculo breviore, spica simplici hirta 8–10-flora stricta bracteis cucullatis apiculatis recurvis, floribus glaberrimis longe pileatis, sepalis apiculatis, petalis obovatis, labello elastice resiliente unguiculato mesochilio rhombeo medio pulvinato epichilio incurvo cochleato ungue lineari carina truncata acuta aucto.

"Epiphyte. River Bagroo, April 1861." (902) *Mann.*

Only one specimen of this curious plant has come home. It is 6 inches high, with flowers about ½ inch long, and throws out a large mass of the thin flat roots that are so common among the leafless Angrecs. Its labellum, which is a long narrow yellow body with an inflexed concave terminal lobe, is thrown back with force when the flower expands, so as to hang down over the pileus formed by the united lateral sepals. By what mechanical contrivance this is effected I have been unable to determine.

### EULOPHIA, *R. Brown.*

1. E. GUINEENSIS, *Lindl. in Bot. Reg.* t. 686.

"Very ornamental. Flower-stem above 3 ft. high. Sepals chocolate. Labellum light red, with darker lines." Shady rocks; Nupe. (1485) *Barter.*

Much larger in all its parts than the garden plant. It is certain that Achille Richard's *Saccolabium abyssinicum* is the same; the species has therefore an unusually extensive range.

2. E. LURIDA, *Lindl. Gen. et Sp. Orch.* p. 182; *Bot. Reg.* t. 1821.
"Flowers brownish." Brass. (2040) *Barter.*

Exactly the same as the garden plant.

3. E. LONGICOLLIS; foliis..., scapo subpaniculato bivaginato, bracteis minimis, pedicellis capillaribus, ovario acuminato, sepalis petalisque lineari-oblongis, labello saccato trilobo calvo laciniis lateralibus semiovatis divaricatis intermedio subrotundo multo brevioribus.
"On *Phœnix spinosa*;" R. Nun. (2121) *Barter.*

Nearly related to *Eulophia lurida*, with a similar pseudobulb clothed with coarse fibres. Scape 6 inches high, with a sheath at the base and a long flattish scale in the middle. Inflorescence as long, with a long narrow membranous bract at the base of each branch. Flowers the size of *E. lurida.* The leaves of this are unknown.

4. E. LUTEA; foliis..., scapo 4-vaginato, racemo simplici, bracteis setaceis pedicellorum longitudine, sepalis petalisque linearibus subæqualibus clausis (?), labello trilobo laciniis lateralibus obtusis subdentatis intermedia spathulata tuberculata breviore calcare recto elongato-conico, columna duplo breviore, anthera mutica.
"Flowers yellow. Grassy valleys, Nupe." (1480) *Barter.*

Leaves unknown. Scapes slender, a foot high. Racemes narrow, many-flowered. Flowers the smallest in the genus, apparently pendulous. The tubercles of the middle lobe of the lip are in about three rows; the uppermost are stalked, the lowest gradually change into minute elevations a little below the isthmus.

5. E. VIRILIS; foliis..., scapo 3-fido ad basin ramorum vaginato, bracteis setaceis deciduis, sepalis petalisque linearibus obtusis æqualibus, labello trilobo ante ostium bidentato: laciniis lateralibus triangulis intermedio cuneato-rotundato emarginato calcare cylindraceo labello adpresso, columna nana baseos lateribus prominulis pubescentibus.
"Epiphyte. Flowers yellowish red. Ambas Bay, Febr. 1861." (782) *Mann.*

A small-flowered species allied to *E. lutea, longicollis,* and *tristis*; the spur, stiff and rising upwards till it becomes parallel with the ascending lip, is remarkable. Pollen-masses not seen.

## GALEANDRA, *Lindley*.

1. G. GRACILIS, *Lindl. Gen. & Sp. Orch.* p. 187.—G. extinctoria, *Ib.*
"Growing on the ground. R. Bagroo, April 1861." (903) *Mann.*

Exactly like our garden plant. *G. extinctoria* was described from an imperfect specimen, and must be cancelled.

2. [G. LONGIBRACTEATA; scapo valido medio vaginato, racemo laxo multifloro, bracteis linearibus acuminatis ovario æqualibus, sepalis petalisque lanceolatis secundis, labello trilobo basi verrucis 2 oblongis parallelis aucto: laciniis rotundatis lateralibus planis intermedia crispa venis quinque cristatis una parva adjecta utrinque ad isthmum.
Sierra Leone, *Whitfield.*

Leaves unknown. Stem 2 feet high. Near *Galeandra euglossa*, Rchb. f., the lip of which has acute lobes, and neither warts nor crested veins.]

## LISSOCHILUS, *R. Br.*

1. L. LONGIFOLIUS, *Bentham in Niger Flora*, p. 530.
"Flowers yellow. Stems 6 feet high, with a spongy creeping rhizome. Swamps, Nupe. (1486) *Barter.* Also Grand Bassa, *Ansell.*

2. L. ROSEUS, *Lindl. in Bot. Reg.* 1843, *Misc.* 37; 1844, t. 12.
"Seven feet high, with pseudobulbous roots. Flowers reddish purple. Base of labellum streaked with orange." Margin of a swampy ravine, Loin Nupe, (1481; also 80 with no locality) *Barter*; side of a rivulet near Pare, (3429) *Id.*

3. L. ARENARIUS; foliis hysteranthiis anguste ensiformibus, scapo gracili laxe vaginato, bracteis setaceo-acuminatis ovario brevioribus, sepalis lanceolatis acutis carinatis reflexis, petalis subrotundis membranaceis, labello subquadrato medio constricto sacco supra basin conico, lamellis 2 cuneatis ad ostium sacci linea elevata interjecta.
"Flowers purple. Base of labellum lined with orange. Flower-stems appear after the first rains, in April; leaves later. Tuber large and flattened." Savannahs in a sandy soil, abundant. (1488) *Barter.*

A noble species, with the stature and appearance of *Bletia verecunda.* Petals full $\frac{3}{4}$ inch long.

4. L. PURPURATUS; foliis hysteranthiis, scapo stricto multifloro, bracteis setaceo-acuminatis ovarii longitudine patentissimis, sepalis oblongis acutis, petalis conformibus obtusis, labelli hypochilio rotundo epichilio angustiore repando undulato calcare brevi conico: lineis 3 tuberculatis lateralibus basi appendiculatis, anthera apiculata.
"Terrestrial; flower-spikes 3 to 4 feet high, appearing before the leaves.

Lip purple, other parts rose-colour. Tubers like kidney potatoes, in chains nearly a yard long; common about Abbeokuta." (3331) *Barter.*

A fine species, readily known by the two great processes standing on either side of the orifice of its little conical spur and terminating the two sides of three glandular lines.

### CYMBIDIUM, *Swartz.*

1. C. ADENOGLOSSUM; foliis hysteranthiis, scapi vaginis 3 ventricosis obtusis, racemo paucifloro bracteis angustissimis linearibus, sepalis secundis basi productis cornutis petalisque minoribus lanceolatis acuminatis, labello trilobo medio carnoso striato: lobis lateralibus cuneiformibus intermedio ovato apiculato rugoso per axin serie duplici tuberculatis, columna elongata semitereti, anthera cristata.

"Nupe, 1859," *Barter.*

Nearly related to the Cape *Cymbidium tabulare*, from which its ventricose stem-sheaths and very different lip abundantly distinguish it. The two lamellæ usually found in the axis of the lip of this genus, when strictly limited, are here confluent into a raised striated ridge.

### ANGRÆCUM, *Thouars.*

1. A. SUBULATUM, *Lindl. in Comp. Bot. Mag.* ii. 205.

"On Mangroves. R. Nun." (2125) *Barter.*

The leaves are much stouter than in the cultivated plant. Very near the *A. ornithorhynchum* of Brazil.

2. A.? sp.

"R. Nun." Label lost. *Barter.*

A plant with the distichous leaves of some Dendrobium, and small few-flowered axillary spikes. All the flowers fallen.

There is another plant in the collection also without flowers ("On Mangroves, R. Nun," 2106, *Barter*) which seems to belong to this genus. And Mann sends a third, equally indeterminable (Nun, 524).

3. A. PELLUCIDUM, *Lindl. in Bot. Reg.* 1844, t. 2.

"Epiphytal. Flowers yellowish white. Labellum, shining as if frosted. Brass." (37) *Barter.*—"Onitscha," (1757) *Barter*, appears to be the same in fruit.

4. A. VESICATUM, *Lindl. in Bot. Reg.* 1843, *Misc.* 9; folio angusto acuminato inæqualiter bilobo, spica pauciflora vaginis bracteisque membranaceis ochreatis, sepalis ovatis cuspidatis petalisque multo minoribus conformibus carnosis, labello lineari-acuminato convexo calcare incurvo

apice maximo vesicato (columna nana, anthera truncata, polliniis caudiculisque *A. pellucidi*).

"Plant of small growth. Flowers pale yellow. Assaba." (1839) *Barter*.

Flowers very fleshy. The column is short and square, like that of *A. eburneum*; but the pollen-masses and caudicles are those of *A. pellucidum*.

5. A. TRIDENS; subacaulis, foliis lineari-lanceolatis obtusis apice obliquis, scapo ascendente capillari distanter vaginato, racemo 3–7-floro erecto, bracteis membranaceis cucullatis, sepalis acutis dorsali recurvo, petalis ovatis acuminatis, labello concavo tripartito laciniis filiformibus, calcare pendulo apice vesicato.

"Epiphyte. Fernando Po, 4000 feet, December 1860." (646) *Mann*.

A small species, with the aspect of a lax-flowered Bolbophyll. Caudicles 2, cuneate, downy. Near *A. vesicatum*.

6. A. VAGANS; foliis oblongo-lanceolatis setaceo-apiculatis, racemis gracilibus multifloris bracteis obsoletis, floribus carnosis, sepalis petalis labelloque conformibus oblongis obtusis, calcare clavato incurvo labello longiore (caudicula lineari didyma).

"Flowers yellow, insignificant. Resembles a gigantic *Vanda*, and covers many of the small islets near the shore. Prince's Island." (1988) *Barter*.

Leaves 8 inches long, 1¾ broad, not very thick. Racemes drooping. The flowers are the size of those of *A. vesicatum*, and very fleshy.

7. A. PERTUSUM, *Lindl. in Comp. Bot. Mag.* ii. 205.

"Flowers white. Brass." (1826) *Barter*.—R. Nun. (—) *Mann*.

The lip of this species varies in being rounded and nearly entire as here, or somewhat acuminate as in the plant first described by me, or truncate and 3-toothed as in what I wrongly distinguished under the name of *A. Pescatoreanum* (Journ. of Hort. Soc. iv. p. 263). In the latter plant the caudicles were certainly not cup-shaped; and therefore I hesitate to adopt Prof. Reichenbach's genus *Listrostachys*. If *Angræcum* is to be broken up, which seems to me quite unadvisable, the structure of the pollen-apparatus must be more exactly ascertained than is possible in dried specimens.

8. A. MONODON, *Lindl. in Paxton's Flower Garden*, ii. p. 102. no. 373. ic. xyl. 187.

"Flowers pale yellow, insignificant. Forests between Otta and Abbeokuta, 1859." (3352) *Barter*.

The solitary specimen is very imperfect, but seems to belong to this species.

9. A. ARCUATUM, *Lindl. in Companion to Botanical Magazine*, ii. 204; *Paxton's Fl. Garden*, ii. 120. no. 396. ic. xyl. 199.
"Epiphyte. Calyx and corolla white. Banks of the Nun, Sept. 1860." (521) *Mann*.

This differs in no respect from the South African plant, except in being much more luxuriant.

10. A. CAUDATUM, *Lindl. in Bot. Reg.* t. 1844.
"Brass." (1858) *Barter*.

11. A. DISTICHUM, *Lindl. in Bot. Reg.* t. 1781.
Brass." (1854) *Barter*.—"Onitscha." (1862) *Id*.—"Prince's Island." (1992) *Id*.—Banks of the Nun, Sept. 1860. (523) *Mann*.

12. A. INFUNDIBULARE; caule flexuoso, foliis lanceolatis obtuse et oblique bilobis, pedunculis filiformibus unifloris oppositifoliis, sepalis petalisque linearibus acuminatis, labello subrotundo-oblongo basi infundibulari in calcar incurvum filiforme pedunculo duplo longius producto.
"Flowers large, white, and fragrant. Prince's Island." (2005) *Barter*.

A beautiful species, belonging to the same set as *A. gladiifolium*, which it resembles on a large scale. The lip is about 2¼ inches long and broad; from the tip to the point of the spur it measures 6 inches. The sepals and petals are 2¼ inches long.

13. A. ICHNEUMONEUM; caulescens, foliis distichis late loratis coriaceis apice obliquis, spicis longissimis gracilibus recurvis, bracteis membranaceis cucullatis, floribus distantibus, sepalis petalisque acutis calcare clavato stipitato multo brevioribus, labello lineari concavo truncato tridentato.
"Epiphyte. Calyx and corolla white. Banks of the Nun, Sept. 1860." (520) *Mann*.

A very fine species. Leaves 15 inches long, and 2 broad; spikes of the same length. The flowers when unexpanded look very like some Ichneumon fly settled on the inflorescence. The two pollen-masses have each a long smooth acuminate caudicle; and two small plates stand perpendicular on either side of the orifice of the spur.

14. A.? sp. No flowers.
"Prince's Island." (2019) *Barter*.

A *Vanda*-like plant, not unlike *A. caudatum*, with narrow leaves. The capsules are solitary, clavate, angular, much shorter than the recurved linear canaliculate leaves.

15. A. IMBRICATUM; caulescens, foliis coriaceis ovato-oblongis obtusis oblique bilobis, spicis sessilibus densis oblongis multifloris bracteis inferioribus ovatis acutis carinatis imbricatis, floribus carnosis, sepalis petalisque ovatis acutissimis, labello oblongo apiculato cucullato basi infundibulari calcare brevi obtuso uncinato, (caudicula simplici lineari, glandula recurva).

"On trees in dense masses abundant in the lower parts of the river. Flowers white, very fragrant, inconspicuous. On still nights the river resembles a close Orchid-house, in which *Cymbidium sinense* is in flower. Onitscha." (1484) *Barter.*

Leaves about 6 inches long by 1½ broad. Spikes 1½ inch long.

16. A. CAPITATUM; acaule, foliis pergameneis loratis basi canaliculatis apice oblique dentatis, spicis sessilibus capitatis radicalibus, bracteis oblongis membranaceis obtusis, sepalis petalisque oblongo-linearibus obtusis membranaceis, labello concavo obtuso rhombeo margine crenulato calcare pendulo apice inflato ovarii longitudine, (anthera rostrata, caudiculis 2 discretis acuminatis, glandula hippocrepica).

"Flowers pale rose-coloured. Brass." (1857) *Barter.*

The plant out of flower resembles some *Maxillaria*, such as *Baueri.* The capitate inflorescence is very remarkable.

## EPIPOGUM, *Gmelin.*

1. E. NUTANS, *Lindl. in Journal of Linnean Society*, i. 177 (Galera nutans, *Blume*).

"Flowers white with purple specks, Ambas Bay, February 1861." (784) *Mann.*

This seems to differ in nothing important from the common Indian form; the two lines of hair on the lip are, however, rudimentary only, and the lip itself is perhaps more fleshy than usual.

## VANILLA, *Plumier.*

1. V. AFRICANA; foliis membranaceis anguste ovalibus acuminatis, spicis basi foliosis, labello trilobo infra medium intus carinato cucullato lobis lateralibus rotundatis intermedio ovato acuto ramentis quibusdum ad apicem carinæ.

"On large trees. Brass." (47) *Barter.*

A slender delicate species, formerly cultivated by Loddiges, with whom it flowered in March 1849, when I gave it the present name, under which it was dispersed.

2. V. sp. No flowers.

"Abundant about Angiama." (2134) *Barter.*

I cannot identify the leaves with those of any published species.

3. V. GRANDIFOLIA; folio coriaceo sessili subrotundo-oblongo venis tribus mediis contiguis, spica brevi crassa lignea.

"Epiphyte. Prince's Island." (1981) *Barter.*

Although only a single leaf and flowerless rachis are in the collection, they may be certainly considered evidence of the existence on Prince's Island of a new *Vanilla* of very large size. The leaf is 7 inches long, and 5 inches broad. The remains of the spike are half as long as the leaf, and bore flowers to the base.

### NOTIOPHRYS, *Lindl. in Proceedings of Linn. Soc.* vol. i. p. 189.

1. N. GLANDULOSA; foliis ovalibus acutissimis, spica densa bracteis ovatis cucullatis dense glandulosis, floribus glabris, labello obovato cucullato apice lunato recurvo basi ventricoso ubi venæ in furcam apice verrucosam dividuntur.

"Terrestrial. Flowers brownish. Prince's Island." (1952) *Barter.*

This very distinct species exactly agrees with the generic character assigned to the other species. Its habit is quite that of *Goodyera* (Notiophrys) *occulta* of Thouars, but it is a much smaller species.

### CORYMBIS, *Thouars.*

1. C. DISTICHA, *Folia Orchidacea sub* Corymbi.

"Herbaceous, 3 to 4 feet high. Flowers white. Fernando Po." (1478) *Barter*; (430) *Mann.*

Prof. Reichenbach ('Bonplandia,' 15 Feb. 1857) has referred to this plant the *Hysteria veratrifolia* of Reinwardt, and *Rhynchanthera paniculata* of Blume's Tabellen, no. 78, the identity of which had been unsuspected in consequence of the erroneous representation of the placenta. Few Orchids have so extensive a range as this, which is found from the Gulf of Guinea to the Feejee Islands, a space of 180 degrees of longitude,—unless, indeed, the genus contains more species than one, as becomes more probable as we acquire better materials. Cuming's plant from the Philippines, for example, seems to be distinct from that of Africa.

### PENTHEA, *Lindley.*

1. P. PUMILIO; caule humili laxe vaginato aphyllo 1–2-floro, labello cuneato tridentato, sepalis infra apicem apiculatis petalisque ovalibus obtusis.

"River Bagroo, April 1861." (904) *Mann.*

A very distinct little species, from 2 to 3 inches high. The flowers, which are as large as those of *P. filicornis*, seem to be orange-coloured. There is no trace of leaves.

### AMPHORCHIS, *Thouars.*

1. A. OCCIDENTALIS; undique tomentosa, folio unico (variegato) oblongo acuto basi cucullato, scapo bivaginato, spica elongata multiflora, petalis glabris truncatis 2–3-dentatis, labello cuneato apice 3-dentato supra carinato, calcare filiformi subclavato dorsali supra labellum curvato.

"Flowers orange. Leaves marked like *Anæctochilus.* But one specimen seen, in a ravine near Jeba Nupe." (1487) *Barter.*

This species confirms Prof. Blume's opinion (Mus. Lugd. Bot. ii. 190) that the genus *Amphorchis* should be distinguished from *Cynorchis.* Its peculiar character consists in the anther being inverted (not horizontal) as in so many Cape Orchids. The plant now described looks like a tomentose state of *Amphorchis calcarata,* but is totally different in its petals, lip, and spur.

### HABENARIA, *W.*

1. H. PALUDOSA; (§ petalis labelloque integerrimis) caule gracili stricto subbifloro folioso, folio infimo lanceolato cucullato superioribus 4 distantibus sensim angustatis setaceo-acuminatis, bracteis cucullatis, sepalis lineari-lanceolatis supremo c. petalis conformibus galeatis, labello lineari-spathulato calcare lineari sepalis longiore, (anthera apiculata basibus loculorum clavatis truncatis breviore, appendice laterali setacea, processibus ovatis, rostello parvo subulato libero).

"Terrestrial. Flowers deep orange. Swamps." Loin Nupe. (1479) *Barter.*

The habit of this is the same as that of *Bonatea pratensis,* to which genus it would be referred, if the genus *Bonatea* could be retained, which is certainly not the case. The stem is from a foot to 14 inches high.

2. H. STENOCHILA; (§ petalis labelloque integerrimis) caule folioso, foliis 5 oblongo-lanceolatis setaceo-acuminatis in bracteis ovario longioribus transeuntibus, spica oblonga multiflora, sepalis lateralibus semiovatis obtusis dorsali petalisque ovato-linearibus multo majoribus, labello lineari, calcare filiformi arcuato ovario duplo longiore apice bidentato, (antheræ basibus angustis ascendentibus, appendice laterali obsoleta, processibus filiformibus elongatis).

"Flowers white, fragrant. Prince's Island." (1995) *Barter.*

Near *H. candida,* but the leaves are broader, the petals and lip very much narrower, and the tip of the spur is not bidentate as in that species.

3. H. MACRANDRA; (§ petalis indivisis, labelli tripartiti laciniis lateralibus setaceis) foliis lanceolatis acutissimis petiolatis caule duplo

brevioribus, vaginis 4 sessilibus lanceolatis inferiore foliacea, racemo laxo 2- plurifloro, bracteis foliaceis acutissimis ovario longioribus, sepalis patentissimis linearibus acuminatis calcare clavato ascendente brevioribus, petalis e lata basi setaceis indivisis, labelli tripartiti laciniis omnibus setaceis, anthera lineari apiculata sepalo dorsali parum breviore.

"Herbaceous plant, 2 feet high; calyx and corolla white and green. Banks of Bonny R., Oct. 1860." (518) *Mann.*

Leaves about 8 inches long, like those of a *Prescottia.* Scape from 7 to 9 inches high, excluding the flowers, which vary in number from two to ten. Sepals rather more than an inch long; spur 3 inches. The whole aspect of the flower is that of a *Bonatea,* without, however, the apparatus of that subgenus. The anther is very nearly as long as the dorsal sepal, a circumstance previously unknown in the genus.

4. H. PRÆALTA, *Lindl. Gen. & Sp. Orch.* p. 321.—Satyrium præaltum, *Thouars, Orch. Afr.* t. 11.

"Top of Clarence Peak, Fernando Po, at 10,000 feet, Dec. 1860." (645) *Mann.*

This does not appear to differ from the Bourbon plant, as far as can be judged from the figure and from a bad specimen given me by the late Achille Richard. One of Mann's two specimens is 2 feet high, the other not quite 5 inches.

## Notes on *Coutoubea volubilis,* Mart., and some other Gentianeæ of Tropical America. By Dr. A. H. R. GRISEBACH, F.M.L.S.

[Read Nov. 7, 1861.]

IN the later set of Mr. Wright's Cuba-plants there occurs a twining herbaceous Gentianea, which agrees (though not in all particulars of its description) with *Coutoubea volubilis,* Mart., or at least is its congener, and may be referred to it, till the comparison of authentic specimens shall settle the question whether it be specifically different: the chief discrepancy, viz. a simple raceme, in Dr. von Martius's description may be accidental. From the structure of the flower, however, the 5-partite calyx, and chiefly from the peculiar stigma and singular habit, it is evidently no true *Coutoubea,* but must form a new genus, to which (*Goeppertia,* Nees, in Laurineæ, proving identical with *Aydendron*) I wish to transfer that vacant name, as an acknowledgment due to the deserving Silesian botanist. The systematical place of *Goeppertia* would be next to *Coutoubea,* which in a certain degree it connects with

*Erythræa.* Its inflorescence is so far interesting, as it tends to show that the true spikes or racemes of *Coutoubea* are to be regarded as composed of cymes, reduced to a single flower, thus passing into the typical cymose inflorescence of *Gentianeæ.*

### GOEPPERTIA, nov. gen.

Calyx 5-partitus, 2-bracteolatus. Corolla infundibuliformis, marcescens: limbo 5-partito. Stamina 5, e tubo corollæ exserta: filamentis brevibus infra faucem insertis: antheris erectis oblongis immutatis. Ovarium 1-loculare: stylo deciduo, stigmate indiviso ovoideo, basi in marginem prominulum producto. Capsula 2-valvis, septicida, valvulis paullo introflexis: semina reticulata, marginalia, funiculis dentiformibus inserta. Herba volubilis: folia lanceolata, paribus plerisque distantibus: cymæ 3-fidæ v. 3-chotomæ, in racemum elongatum dispositæ (aut sec. Mart., racemus simplex, terminalis).

G. VOLUBILIS, *Gr.* Syn. *Coutoubea,* Mart. Caulis pluripedalis, tenuis, teretiusculus, superne ramosus, internodiis mediis 3″ longis; folia 1″ longa, 2‴ fere lata, acuminata, basi contracta vaginantia, uninervia, obscure venosa, margine sæpe revoluta; axis inflorescentiæ 6–10″, internodia ejus 1–1½″ longa, cymis pedunculum, calycibus pedicellum, subæquantibus, bracteis bracteolisque linearibus, his brevioribus; calyx bracteolis multo longior; segmentis lanceolatis, acuminatis, apice recurvis, margine membranaceis, tubo corollæ parum superatis; corolla habitu Erythrææ, "ochroleuca" (Mart.), fere ad medium divisa: tubo 2‴ longo, lobis dextrorsum contortis, elliptico-oblongis, obtusis, anthera duplo longioribus; capsula ovoidea, 2‴ longa.

*Hab.* In Cuba orientali (*Wright,* No. 1372); *C. volubilis* in Haïti (*Bertero*).

Mr. Bentham (Hook. Journ. of Bot. vi. p. 193) has published some emendations to my arrangement of *Gentianeæ,* and, while generally approving of his views, I take this opportunity to add a few observations. In *Coutoubea* Mr. Bentham follows Kunth in regarding *C. spicata,* Aubl., as *C. densiflora,* Mart. Indifferent figures of old authors will often remain doubtful, but in this case I still believe that Martius was quite right in separating his species; for in Aublet's figure the flowers are much more distant, and the leaves not contracted at the base, while in his description I find nothing which would not apply to the plant I have described under his name. Now, as my own *C. spicata* proves to be identical with *C. reflexa,* Benth., of which I now compare specimens from Guiana (R. Schomb. no. 1060) and from Bogota (*C. spicata* in Goudot's Coll.), it is evident that there is no difference in Mr.

Bentham's views on the species to be distinguished, but merely in the interpretation of Aublet's figure. In Lamarck's Illustration there is a confusion between *C. spicata* and *C. ramosa*; for his figure (t. 79) designated *C. alba*, which is a translation of Aublet's French name of his *C. spicata*, belongs to *C. ramosa*, Aubl.; but, bad as it is, this figure was by mistake quoted in the 'Prodromus' under both species.

The genus *Apophragma* I established (as was indeed not advisable) from Aublet's description and figure (t. 26. f. 2, 9, 10), exhibiting exserted stamens and a "stigmate à deux lames larges et aigues:" at the time of its publication I wanted sufficient materials to verify this structure. But as the habit is exactly the same as in the common plant designated *Schübleria tenuifolia*, Don, (Benth.!), and identical with my own specimens of *Apophragma*, Aublet's analysis is probably erroneous: hence Bentham correctly reduced *Apophragma* to *Schübleria*. In his paper there are, however, several errors (partly typographical ones) with regard to Aublet's figures. I had not taken, as he presumed, the characters of *Apophragma* from t. 26. f. 4–7, which belong to *Schultesia*, but from f. 9, 10 (both correctly quoted by Aublet), and the "appendiculate filaments" occur in Aublet's description: f. 1, again, or *Exacum guianense*, is *Schultesia*; f. 2, *E. tenuifolium*, or *Schübleria* (Benth.).

*Reichertia* was separated by Karsten from *Schultesia* on account of its bidentate filaments: such a structure exists in *Sch. stenophylla* itself, the first-published species of the genus, and is evidently of no generic importance.

*Erythræa*, *Cicendia*, *Microcala*, *Xestæa*, and *Orthostemon* are mere artificial distinctions. From its twisted anthers, *Erythræa* might be preserved, as it is; though *E. quitensis*, Kth., during anthesis, is devoid of torsion, or shows only a single slight anfractuosity, but it is more or less twisted in the dry state afterwards. The knowledge of the species of *Erythræa*, chiefly of the American ones, is now less satisfactorily settled than at the time of my publication. Its later edition, contained in DeCandolle's 'Prodromus,' the proofs of which could not be corrected by myself, is often obscured by misprints, which may usually be improved by comparison with my monograph and the article on *Gentianeæ* in Hooker's Fl. Bor.-Amer. For instance, there was no *E. tenuifolia*, Gr., in my manuscript, this name belonging, as var. γ, to the preceding *E. linarifolia*, as was to be seen from the form of its diagnosis, though overlooked by subsequent authors. Dr. Schlechtendal (Bot. Zeit. xiii. p. 915) has republished, from a Mexican periodical, Schiede's paper on two Mexican *Erythrææ*, and he describes a third considered as new by Schaffner: of these I possess two collected by Schaffner. His no. 15 (agreeing with *E. divaricata*, Schaffn.) is nothing but a broad-leaved form of the common *E. quitensis*, Kth., a species ranging from the coast of Northern Mexico (Ervendberg, no. 186!) through the mountains of Guatemala (Wendl.!) and Costa Rica (Oerst.!): the original, lower form, with narrower leaves, was collected likewise in Guatemala (Wendl.!), and grows besides in Venezuela (Moritz!) and Quito (Jameson!). In the diagnosis of *E. tetramera*, Schiede, I find nothing which would prevent me from referring it to *E. quitensis*. The second species sent by Schaffner (no. 13), or *E. stricta*, Schiede, agrees with the description of *E. floribunda*, Benth. My *E. Mühlenbergii* was confined by Asa Gray to a species ranging from California to New Mexico, while he reduces the Pennsylvanian plant to the *E. ramosissima*, Pers., which he declares identical with the doubtful *Exacum pulchellum*, Pursh: this is undoubtedly a correct emendation, as Mr. Marsh found the true European species even as far south as Jamaica (probably introduced along the Atlantic with foreign grain). Among the doubtful *Erythrææ*, *E. elodes*, R. S., upon Godron's authority, is *Elodes palustris*; and to *E. Massoni*, Linn. (from an Azoric specimen) may be reduced *E. diffusa*, Woods, which is apparently indeed perennial, as stated by Lejolis, though contradicted by Grenier.

The distinction of the four remaining genera is more questionable, and I should now rather prefer regarding *Microcala* as a section of *Cicendia*; for an intermediate group of species (*Stenocala*) would be formed by *C. exaltata* and by a new Guatemalan species, discovered by Mr. Wendland, as appears from the following review of the genus.

### CICENDIA.

Sect. 1. *Hippocentaurea*, Reichenb. Calyx 4–5-partitus.

1. *C. pusilla*, Gr. (Syn. *C. Candollei*, Gr.)
2. *C. Poeppigii*, Gr.
3. *C. fastigiata*, Gr.

Sect. 2. *Stenocala*. Calyx ad medium 4-fidus.

4. *C. exaltata*, Gr.
5. C. STRICTA, Gr. (n. sp.); caule gracili in pedunculas strictas sæpe unilaterales diviso, foliis inferioribus spathulato-lanceolatis obtusiusculis, superioribus linearibus decrescentibus, calycis lobis ovato-

lanceolatis acutis tubum ovatum æquantibus, corollæ "rubellæ" tubo exserto tenui lobis obovato-oblongis longiore, capsula ovoideo-oblonga, uniloculari: placentis intus non prominulis.

*Herba* spithamea, annua; folia inferiora 8‴ longa, 2‴ lata, internodiis longiora, superiora distantia, internodiis crescentibus ultrapollicaribus; pedunculi sæpe æquilongi cymam racemiformem a medio caule constituentes; calyx 1½‴, corollæ tubus 3‴ longus; antheræ ovales, incumbentes, paullo exsertæ, filamento tenui; stylus ovario brevior, stigmate late capitato; capsula 3‴ longa.

*Hab.* In Guatemala, pr. Las Nubes (*Wendl.*, mense Januar.); forma minus elongata in vulcano Frasu, Costaricæ, alt. 9000 ped. (*Wendl.*, m. April.).

### Sect. 3. *Microcala*, Lk. Calyx 4-dentatus.

6. *C. filiformis*, Reichenb.
7. *C. quadrangularis*, Gr.

Of *Lisianthus*, sect. *Brachycodon*, Benth., I possess his *L. pumilus*, which proves a congener of *Pagæa*; and probably *L. ramosissimus*, Benth., is *P. Poeppigii* itself. Mr. Bentham observed the anthers to be at length recurved: hence there remain, to distinguish it from *Lisianthus*, the higher insertion of the stamens, the form of the corolla, and the very different habit. In the true *Lisianthi*, the enlargement of the connective on the back of the anther-cells is peculiar; and this character, if compared throughout the genus, may perhaps be of some value in the discrimination of *Pagæa*. In the section *Helia* (viz. in *L. brevifolius* and *L. chelonoides*), the structure of the anthers is the same as in *Chelonanthus* and *Macrocarpæa*: in both species they are at length recurved, and in the former the connective is apiculate: hence the character of *Helia* is chiefly confined to a marcescent corolla, and less peculiar than was supposed. A double placenta in each capsule-cell occurs likewise in *L. chelonoides* (a really annual species, from Kegel's specimens) and in *L. alatus*, Aubl., to which I reduce my *L. Oerstedii*. If this identification proves correct, Aublet's species must be transposed to *Helia*. *L. tetragonus* and *L. auriculatus*, Benth., have been reduced by their author to *L. acutangulus*, Bot. Mag., which is *L. trifidus*, Kth., but not *L. fistulosus*, Poir., the latter, from an authentic specimen, having purple flowers.

The sections *Chelonanthus* and *Macrocarpæa* are to be united, being only distinguished by the shrubby growth of the latter: the shape of the capsule proves of no sectional importance.

My supposition that *Symbolanthus* is little distinguished from the section *Leiothamnus* is confirmed by a beautiful *Lisianthus*

collected by Mr. Wendland in Central America, the rosy-violet flowers of which are four or five inches long. The structure of its ovary is the same as in *Lisianthus* (ovarium biloculare, placenta laminata utrinque duplici); but the plant is anomalous in the genus by having the large hypogynous ring of *Tachia*. Except in the larger size of flowers (but not so much as, from a misprint in its description, it would appear), this shrub agrees sufficiently with the figure of *L. calygonus*, R. P., or is at least nearly allied to this and to *L. daturoides*.

*Petasostylis* is an artificial genus, chiefly distinguished from *Leianthus* by a two-celled capsule. Both species, collected again by Mr. Wendland (*P. saponarioides* in Costa Rica, *P. nigrescens* in Guatemala), are variable in the size of the flowers: the corolla of both is often two inches long, and the lobes (much too long in the figure of Bot. Mag. t. 4043) only 3–4‴, as described by Schlechtendal.

In Eastern Cuba a remarkable new *Lisianthea* was discovered by Mr. Wright (no. 1346), which, though my materials do not allow the dissection of more than two flowers and a single fruit, may be regarded as a link between *Lisianthus*, of which it has the anthers, and *Leianthus umbellatus*, which it approaches by its axillary peduncles and prominulous leaf-sheaths.

### ZONANTHUS, nov. gen.

Involucrum calycem cingens, foliolis geminis rotundatis in tubum breviorem connatis, tubo cupuliformi apice intus in marginem annularem integrum productis. Calyx campanulatus, ecarinatus, demum fissilis, 5-lobus, lobis quadrato-subrotundis planis imbricatis margine membranaceis. Corolla hypocraterimorpha, dextrorsum contorta, ad medium fere 5-loba, tubo campanulato, lobis oblongis obtusis. Stamina medio corollæ tubo inserta, filamentis exsertis, antheris incumbenti-recurvis, loculis connectivo dilatato adnatis. Ovarium placentis suturalibus divisis semi-4-loculare, stylo elongato, stigmate 2-lamellato. Capsula septicida, bivalvis, carpidiis 2 introflexis semi-4-locularis, placentis polyspermis marginalibus, testa reticulata. Frutex, foliis spathulato-oblongis petiolatis, petiolis in vaginam annularem connexis; pedunculi axillares, solitarii, folia subæquantes, uniflori; corolla virens.

Z. CUBENSIS, *Gr.* Rami teretiusculi, internodiis brevibus; folia 3–4″ longa, obtusiuscula, arcunervia, in petiola 6–10‴ longa attenuata; pedunculi 3″, calyx 8‴, involucri tubus ei appressus 3–4‴ longus,

lobis ejus patulis calycem subæquantibus; corollæ tubus 9''', lobi 8''' longi, 2-3''' lati; capsula oblongo-lanceolata, glutinoso-nitens, fere sesquipollicaris.

*Hab.* In montibus S. Cataline Cubæ orientalis.

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## On *Inocarpus*. By GEORGE BENTHAM, Esq., P.L.S.

[Read Feb. 20, 1862.]

AMONGST the plants sent in 1836 from British Guiana by Sir Robert (then Mr.) Schomburgk were some specimens which, he informed me, were gathered from a most beautiful tree, almost covered with bright-yellow flowers, and called by the natives Etabally, on account of its frequency at the cataracts of that name on the Essequebo. Recognizing in them the general characters of Leguminosæ of the suborder Cæsalpinieæ, but with many differences from all published genera of that group, I described them in Hooker's 'Journal of Botany,' ii. p. 99, as a new genus, under the name of *Etaballia*; and some years afterwards, Dr. Hooker figured it for me in Hooker's 'Icones,' t. 453, 454. At the same time, I found amongst some unnamed specimens from the Isle of St. Vincent's one so closely resembling the *Etaballia* in general foliage, inflorescence, calyx, and petals, that, although I could not then dissect the flowers, I thought I might venture to allude to it as a second species, to which I gave the name of *E. macrophylla*. This, however, proved to be a cultivated specimen of *Inocarpus edulis*; and as that genus had been described with characters totally incompatible with Leguminosæ, and had been referred either to Sapotaceæ or to Hernandieæ, I laid it aside without further examination, vexed at having brought together into one genus plants belonging to such very different orders. Recently, however, Dr. Hooker and myself had occasion to examine *Inocarpus*, of which we have now very complete flowering specimens from the South Pacific Islands, as well as from various tropical botanical gardens; and we found that the received account of the structure of the ovary is in some important respects erroneous, and that the genus is in fact, as it is in appearance, closely allied to *Etaballia*, and must be placed next to it in Leguminosæ, notwithstanding the gamopetalous corolla. The union indeed of the petals at their base, or rather by their claws, is but little more than that which occurs in most Trifoliums, in several Mimoseæ, &c.; the ten monadelphous stamens are such as are frequent in Leguminosæ; and the ovary is characteristic of that order, this being perhaps the only organ by which Leguminosæ can be always recognized through all their varied modifications. In *Etaballia* it consists of a single carpel with a very short terminal but excentric style, and two or three amphitropous ovules with a superior micropyle attached to the upper or inner angle of the cavity, that is, to the side from which the style proceeds. Only one of these ovules comes to maturity; and in one already faded flower I could find only a single ovule, but of the usual form and attachment, and not anatropous nor pendulous from the summit of the cavity, as described by Endlicher. I do not think, however, that this skilful botanist ever examined *Inocarpus* himself. At the time of the publication of his 'Genera,' it was rare in herbaria; and the statement that the ovule was pendulous from the top of the cavity must have been taken from Roxburgh, the only botanist since Rumphius and Forster who has described the plant from actual specimens; and an inspection of the rude and certainly incorrect analysis in the plate of the Coromandel plants (t. 263) probably induced Endlicher to suppose that the ovule must be anatropous. The conversion of the calyx and corolla into an outer calycule and a simple perianth is another proof that Endlicher's character was compiled from books; for an examination of the plant would have shown him that the two lobes of the calyx are not the summits of two united bracts, but formed by the cohesion of the normal five teeth of the calyx into two or sometimes three lobes, as shown by their venation, and sometimes by minute teeth at the apex.

From these incorrect notions of the structure of the flowers which had obtained, it is not to be expected that the place of *Inocarpus* in the natural system could have been accurately fixed. Jussieu, having only Forster's and Thunberg's characters to judge from, referred it to the "genera *Sapotis* affinia;" and, as far as then known, several technical points appeared to connect it with that order. Endlicher, however, studying apparently Roxburgh's figure, sought to connect it with *Hernandia*, in a small group annexed to Thymeleæ; and there more recent authors have left it, raising however the group to an independent order of Monochlamydeæ, under the name of Hernandiaceæ. Even Miquel, in his 'Flora van Nederlandsch Indië,' adopts this view, extracting his characters from Endlicher, although a slight examination of specimens of the two plants, of which he must have had abundance at his disposal, would have shown him that they differed as widely in most of their essential characters as in habit. In the 'Prodromus,' *Inocarpus* is excluded from Sapotaceæ on the authority of Endlicher; and neither that genus nor *Hernandia* is alluded to under Thymeleæ. All these doubts may now be considered as removed by the reference of *Inocarpus* to Leguminosæ; whilst *Hernandia* remains far away amongst unisexual Monochlamydeæ, allied to those Euphorbiaceæ in which the albumen almost or completely disappears.

The so-called nut, but rather the kernel or seed, of *Inocarpus edulis* appears to be extensively eaten in its native country, and more especially in some of the eastern islands of the Indian Archipelago, where it is said to be very abundant. Rumphius says that, when boiled or roasted in ashes, it is sweet like the Spanish eatable acorns, much prized by the natives of several of the islands, and that in Machian they almost live upon it. According to George Forster, it replaces chestnuts in the Society and Friendly Islands; but is less agreeable, although sweetish, and is ill suited to weak stomachs. Roxburgh, who raised the tree in the Botanic Garden of Calcutta, says that the kernel is certainly eatable, but by no means palatable. Like the *Etaballia*, this tree appears to be hard-wooded and of considerable beauty. The flowers are described as of a pale yellow.

According to Rumphius, the tree yields a resinous glutinous juice, into which the Papuans steep the tips of their arrows, giving them a black colour; and this statement is copied by Forster and subsequent writers. There is some doubt, however, whether Rumphius has not confounded two different trees in his article "Gajanum," Herb. Amboin. i. 170, t. 65, universally referred to *Inocarpus* on the authority of Thunberg. The fruit is indeed so described by Rumphius as to leave little doubt as to its identity, but his representation of the flowers does not at all agree with those of *Inocarpus*. They are figured as borne on long pedicels in a short loose raceme; and the petals are lanceolate, not linear. In all our specimens, wild or cultivated, they are either closely sessile, or the pedicel is so short as to be scarcely perceptible even after the fruit is considerably enlarged, although the stipes of the fruit may then, after the calyx has fallen off, answer the appearance of a pedicel. Forster says indeed that the flowers are "brevissime pedicellati," and that the inflorescence is a raceme, and not a spike; but, in the loose sense in which these words were formerly taken, he may mean that the flowers are distant from each other, and not close together. Forster also describes the flowers as occasionally 6-merous, with twelve stamens; but this must have been accidental. We find them always 5-merous, and Roxburgh so describes them.

With regard to *Etaballia*, there are still some points of affinity and nomenclature to clear up. Dr. Sagot, in his active and scientific explorations of French Guiana, found near Karouany a tree supplying a hard wood, called Boco in the country, and which, from this name and from the station, he concludes to be the *Bocoa provacensis* described and figured by Aublet (Pl. Gui. Supp. 38, t. 391), from specimens without flower or fruit. Dr. Sagot's specimens are in fruit, showing with certainty that they belong to Leguminosæ. He had not seen the flowers; but the foliage and inflorescence, of an unusual description in that order, are so nearly those of *Etaballia*, that he suggested that the two might be at least congeners, if not of one and the same species, and in that case Aublet's older name should be preferred. A further comparison, however, throws some doubt even as to their generic identity. In *Etaballia* the ovary is sessile and very villous, and the funiculus exceedingly short. In *Bocoa* the youngest fruits we have are perfectly glabrous and shortly stipitate; the ovules, even those which are not at all enlarged, are borne on a filiform funiculus at least three times as long as themselves; and as the seed enlarges, this funiculus lengthens in a most remarkable manner, folding itself and coiling backwards and forwards round the outside of the seed, so as almost to enclose it. Until therefore we have seen the flowers of *Bocoa* and the fruit of *Etaballia*, it is most prudent to maintain the two genera as distinct.

Again, as to the name *Etaballia*, Sir R. Schomburgk, in his later expeditions, learned that it was not this tree, but a species of *Vochysia*, which the natives named after the cataract. These errors as to native names are so frequent that their use in botanical nomenclature ought to be restricted to very exceptional cases; but, in the present instance, if *Etaballia* does not merge into *Bocoa*, the rule of priority—one of the most important to maintain in botanical nomenclature—would require the retention of that name, notwithstanding the probability of its original incorrectness.

The following are the technical characters of the three genera, independently of those which are common to all Cæsalpinieæ.

1. INOCARPUS. *Forst. Char. Gen.* p. 65, t. 33. Calyx tubuloso-campanulatus, 2- rarius 3-lobus, lobis rotundatis. Petala 5, basi in tubum coalita, supra calycem libera, linearia, subæqualia, imbricata summo intimo, apice corrugato-involuta. Stamina 10, filamentis in tubum corollæ adnatum alte coalitis, alterna longiora; antheræ consimiles,

breves didymæ. Ovarium subsessile. Stylus brevissimus, stigmate oblique dilatato-concavo. Ovula 2–3, rarissime solitaria, amphitropa, subascendentia funiculo brevissimo suturæ appensa. Legumen breviter stipitatum, obovato-incurvum, subdrupaceum, sarcocarpio tenui, endocarpio crasso fibroso, monospermum. Semen late ovatum, funiculo brevissimo turbinato-incrassato affixum. Testa rigide membranacea, reticulato-venosa. Albumen 0. Cotyledones crasso-carnosæ, radicula brevissima supera leviter incurva. "Plumula squamulis minimis imbricatis obtecta."

Arbor excelsa, glabra. Folia simplicia (unifoliolata), brevissime petiolata, ovali-oblonga, penninervia, coriacea. Stipulæ parvæ. Spicæ axillares laxæ. Flores pallide flavi, ad axillas bractearum parvarum sessiles v. subsessiles, bracteolis minutis v. inconspicuis.

Species unica, *I. dulcis*, Forst., in insulis Oceani Pacifici v. Archipelagi Indici spontanea v. culta. Semina edulia. *Gærtn. f. Fruct.* iii. t. 199, et 200. f. 1. *Roxb. Pl. Corom.* iii. t. 263.

2. ETABALLIA. *Benth. in Hook. Journ. Bot.* ii. 99. Calyx tubulosus, 5-dentatus v. dentibus summis coalitis 4-dentatus. Petala 5, libera v. vix ima basi tubo stamineo coalita, linearia, subæqualia, imbricata summo intimo, apice corrugato-involuta. Stamina 10, hypogyna, alte monadelpha, alterna paullo longiora; antheræ consimiles, breves, didymæ. Ovarium sessile. Stylus cylindricus, stigmate obliquo parum incrassato. Ovula 3–4, amphitropa, funiculis brevissimis appensa. Legumen......

Arbor pulcherrima, ramis glabris. Folia simplicia (unifoliolata), brevissime petiolata, ovata v. ovato-oblonga, penninervia, coriacea, glabra v. subtus puberula. Stipulæ parvæ. Spicæ axillares v. terminales, densæ, novellæ bracteis imbricatis lupulinæ. Flores flavi, ad axillas bractearum mox deciduarum solitarii, sessiles, bibracteolati. Calyx ferrugineus. Ovarium villosum.

Species unica Guianensis. *Hook. Ic. Pl.* t. 453, 454.

3. BOCOA. *Aubl. Pl. Gui.* t. 391. Calyx tubulosus?, deciduus. Petala... Stamina...... Ovarium breviter stipitatum? ovulis paucis funiculo longo appensis. Legumen (parvum) breviter stipitatum, oblique ovato-subfalcatum, coriaceum, bivalve. Semen unicum, funiculo longissimo filiformi contortuplicato ad hilum turbinato-incrassato semen extus pluries circumdante; albumen 0; cotyledones crassiusculæ; radicula brevissima.

Arbor glaberrima ligno durissimo. Folia simplicia (unifoliolata), breviter petiolata, ovata, penninervia, coriacea, nitida. Stipulæ parvæ v. inconspicuæ. Spicæ ad nodos vetustos solitariæ v. fasciculatæ.

Species unica Guianensis. Flores ignoti. Ovarium jam auctum breviter stipitatum, glaberrimum. Semina in speciminibus immatura.

# On the Three remarkable Sexual Forms of *Catasetum tridentatum*, an Orchid in the possession of the Linnean Society. By CHARLES DARWIN, M.A., F.R.S., F.L.S.

[Read April 3, 1862.]

THE President and Officers of the Linnean Society having kindly permitted me to examine the remarkable specimen, preserved in spirits in their collection, of an Orchid bearing flowers of two supposed genera, and known sometimes to bear the flowers of a third genus, I have thought that the Society might like to hear a short account and explanation of this singular case. The following details will hereafter appear in a small work on the 'Fertilization of Orchids by Insect-agency,' which I am preparing for early publication.

Botanists were astonished when Sir R. Schomburgk* stated that he had seen three distinct forms, believed to constitute three distinct genera, namely *Catasetum tridentatum*, *Monachanthus viridis*, and *Myanthus barbatus*, all growing on the same plant. Lindley† remarked that "such cases shake to the foundation all our ideas of the stability of genera and species." Sir R. Schomburgk affirms that he has seen hundreds of plants of *C. tridentatum* in Essequibo without ever finding one specimen with seeds‡, but that he was surprised at the gigantic seed-vessels of the *Monachanthus*; and he correctly remarks that here we have traces of sexual difference in Orchideous flowers.

The general appearance of the flower of *Catasetum tridentatum*, in its natural position, is given in the diagram, p. 152 (fig. 1); but the two lower sepals have been cut off. The column is figured separately in an upright position, showing the two curious prolongations of the rostellum, or, as I shall call them, the antennæ.

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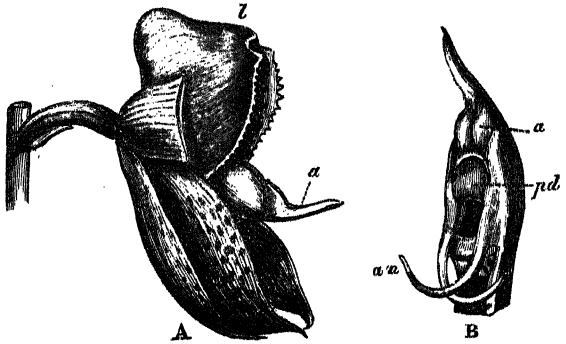
* 'Transactions of the Linnean Society,' vol. xvii. p. 522. Another account, by Dr. Lindley, has appeared in the 'Botanical Register,' vol. xxiii. fol. 1951, of a distinct species of *Myanthus* and *Monachanthus* appearing on the same scape: he alludes also to other cases. Some of the flowers were in an intermediate condition, which is not surprising, seeing that in diœcious plants we sometimes have a partial resumption of the characters of both sexes. Mr. Rogers, of River Hill, informs me that he imported from Demerara a *Myanthus*, but that when it flowered a second time it was metamorphosed into a *Catasetum*. Dr. Carpenter ('Comparative Physiology,' fourth edition, p. 638) alludes to an analogous case which occurred at Bristol.

† 'The Vegetable Kingdom,' 1853, p. 178.

‡ Brongniart states (Bull. de la Soc. Bot. de France, 1855, tom. ii. p. 20) that M. Neumann, a skilful fertilizer of Orchids, could never succeed in fertilizing *Catasetum*.

A deep chamber, which from its homological relations must be called the stigmatic chamber, lies between the bases of the antennæ; and the anther, with its concealed pollen-masses, is seated above. My object is not here to describe in detail the structure of the flower and its curious mechanism. But it must be observed that the ovarium is much shorter, thinner, less deeply furrowed, more solid in the centre, and the bract at its base smaller, than in the two succeeding sexual forms presently to be described. The ovarium is bent so that the bucket-like labellum stands uppermost, instead of forming the lower lip as in most Orchids

Fig. 1.



CATASETUM TRIDENTATUM.

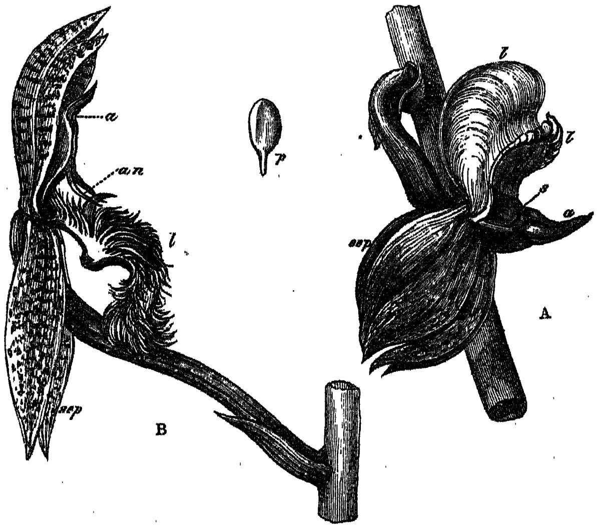
*a.* anther.
*an.* antennæ.
*pd.* pedicel of pollinium.
*l.* labellum.

A. Side view of flower in its natural position with the properly lower sepals cut off.

B. Front view of column, placed upright.

From what I had myself observed previously to reading Sir R. Schomburgk's paper, I was led to examine carefully the female organs of this species, and, I may add, of *C. callosum* and *C. saccatum*. In no case was the stigmatic surface viscid, as it is in all other Orchids (excepting *Cypripedium*), and as is indispensable for securing the pollen-masses on the rupture of the caudicles. I carefully looked to this point in both young and old flowers of *C. tridentatum*. When the surface of the stigmatic chamber and of the stigmatic canal of the above-named three species is scraped off, after having been kept in spirits of wine, it is found to be composed of utriculi (with nuclei of the proper shape), but not nearly so numerous as with ordinary Orchids. The utriculi cohere more together, and are more transparent. I examined for comparison the utriculi of many kinds of Orchids, which had been kept in spirits, and in all found they were much less transparent. Again, in all three species of *Catasetum* the ovule-bearing cords are short, and the ovules present a considerably different appearance, in being thinner, more transparent, and less pulpy than in the numerous other Orchids examined for comparison. They were, however, in not so completely an atrophied condition as in the genus *Acropera.* Although they correspond so closely in general appearance and position with true ovules, perhaps I have no strict right so to designate them, as I was unable in any case to make out the opening of the testa and the included nucleus; nor were the ovules ever inverted. From these several facts—namely, the shortness, thinness, and smoothness of the ovarium, the shortness of the ovule-bearing cords, the state of the ovules themselves, the stigmatic surface not being viscid, the empty condition of the utriculi—and from Sir R. Schomburgk never having seen *C. tridentatum* producing seed in its native home, we may confidently look at this species of *Catasetum*, as well as the other two species, as male plants.

Fig. 2.



MYANTHUS BARBATUS.
*a.* anther.
*an.* antennæ.
*l.* labellum.

MONACHANTHUS VIRIDIS.
*p.* pollen-mass, rudimentary.
*s.* stigmatic cleft.
*sep.* two lower sepals.

A. Side view of *Monachanthus viridis* in its natural position.
(The shading in both drawings has been added from M. Reiss's drawing in the 'Linnean Transactions.')
B. Side view of *Myanthus barbatus* in its natural position.

With respect to *Monachanthus viridis* and *Myanthus barbatus*, these two forms are seen, in the specimen sent home by Sir R. Schomburgk, and preserved in spirits in the Society's collection, to be borne on the same spike. They are represented in the diagrams, page 153. The flower of the *Monachanthus*, like that of the *Catasetum*, grows lower side uppermost. The labellum is not nearly so deep, especially on the sides, and its edges are crenated. The other petals and sepals are all reflexed, and are not so much spotted as in the *Catasetum*. The bract at the base of the ovarium is much larger. The whole column, especially the filament at its summit and the spike-like anther, is much shorter; and the front of the rostellum is much less protuberant. The antennæ or horn-like prolongations of the rostellum are entirely absent. The pollen-masses are rudimentary: I could find no trace of a viscid disk or of a pedicel; if they exist, they must be quite rudimentary, for there is hardly any space for the imbedment of the disk. The absence of the antennæ in this Orchid, which has no pollen-masses to eject, is an interesting fact, as it accords with the view to which I have been led by an examination of three living species of *Catasetum*, namely, that the function of the antennæ is to convey the stimulus of a touch to the medial part of the rostellum, causing the membrane round the disk to rupture, and consequently the liberation and ejection of the pollen-masses. Instead of a large stigmatic chamber, there is a narrow transverse cleft close beneath the small anther. I was able to insert one of the pollen-masses of the male *Catasetum* into this cleft, which, from having been kept in spirits, was lined with coagulated beads of viscid matter and with utriculi. The utriculi, differently from those in *Catasetum*, were charged (after having been kept in spirits) with brown matter. The ovarium is much longer, thicker near the base, and more plainly furrowed than in *Catasetum*; the ovule-bearing cords are also much longer, and the ovules more opake and pulpy, as in all common Orchids. I believe that I saw the opening at the partially inverted end of the testa with a large nucleus projecting; but as the specimens had been kept many years in spirits, and were somewhat altered, I dare not speak positively. From these several facts it is almost certain that *Monachanthus* is a female plant; and Sir R. Schomburgk saw it seeding abundantly. Altogether this flower differs in a most remarkable manner from that of the male *Catasetum tridentatum*, and it is no wonder that they were formerly ranked as distinct genera.

The pollen-masses offer so curious and good an illustration of a structure in a rudimentary condition, that they are worth description; but first I must briefly describe the perfect pollen-masses of the male *Catasetum*. These consist of a large sheet of cemented or waxy pollen-grains, folded over so as to form a sac with an open slit along the lower surface; into this slit cellular tissue enters whilst the pollen is in the course of development in the bud. Within the lower and produced end of each pollen-mass a layer of highly elastic tissue, forming the caudicle, is attached, the other end being attached to the strap-shaped pedicel of the pollinium. The exterior grains of pollen are more angular, have thicker walls, and are yellower than the interior grains. In the early bud the two pollen-masses are enveloped in two conjoined membranous sacs, which are soon penetrated by the two produced ends of the pollen-masses, and by their caudicles; and then the ends of the caudicles adhere to the pedicel. Before the flower expands, the membranous sacs including the pollen-masses open, and leave them resting naked on the back of the rostellum.

In *Monachanthus* the two membranous sacs containing the rudimentary pollen-masses never open; they easily separate from each other and from the anther. The tissue of which they are formed is thick and pulpy. Like most rudimentary parts, they vary greatly in size and in form. The included, and therefore useless, pollen-masses are not one-tenth of the bulk of the pollen-masses of the male: they are flask-shaped, with the lower and produced end greatly exaggerated, and almost penetrating through the exterior or membranous sac. The flask is closed, and there is no fissure along the lower surface. The exterior pollen-grains are square and have thicker walls than the interior grains, just as in the proper male pollen; and what is very curious, each cell has its nucleus. Now R. Brown* states that, in the early stages of the formation of the pollen-grains in ordinary Orchids, a minute areola or nucleus is often visible; so that the rudimentary pollen-grains of the *Monachanthus* apparently have retained (as is so general with rudiments in the animal kingdom) an embryonic character. Lastly, at the base, within the flask of pollen, there is a little sheet of brown elastic tissue—that is, a vestige of a caudicle—which runs far up the produced end of the flask, but does not (at least in some of the specimens) come to the surface, and could not have been attached to any part of the rostellum. These rudimentary caudicles are, therefore, utterly useless.

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* Transactions of the Linnean Society, vol. xvi. p. 711.

We thus see that every single detail of structure of the male pollen-masses, with some parts exaggerated and some parts slightly modified, is represented by these mere rudiments in the female plant. Such cases are familiar to every observer, but can never be examined without renewed interest.

We now come to the third form, *Myanthus barbatus*, often borne on the same plant with the two preceding forms. Its flower, in external appearance, but not in essential structure, is the most different of all. It generally stands in a reversed position, compared with *Catasetum* and *Monachanthus*—that is, with the labellum downwards. The labellum is fringed, in an extraordinary manner, with long papillæ; it has a quite insignificant medial cavity, at the hinder margin of which a curious curved and flattened horn projects. The other petals and sepals are spotted and elongated, with the two lower sepals alone reflexed. The antennæ are not so long as in the male *C. tridentatum*, and they project symmetrically on each side of the horn-like projection at the base of the labellum, with their tips (which are not roughened with papillæ as in the male flower) almost entering the medial cavity. The stigmatic chamber is of nearly intermediate size between that of the male and female forms; it is lined with utriculi, charged with brown matter. The straight and well-furrowed ovarium is nearly twice as long as in *Monachanthus*, but is not so thick where it joins the flower; the ovules are not so numerous as in the female form, but are opake and pulpy after having been kept in spirits, and resemble them in all respects. I believe, but dare not speak positively as in the case of the *Monachanthus*, that I saw the nucleus projecting from the testa. The pollinia are about a quarter of the size of those of the male *Catasetum*, but have a perfectly well developed disk and pedicel. The pollen-masses were lost in the specimens examined by me; but fortunately M. Reiss has given, in the 'Linnean Transactions,' a drawing of them, showing that they are of due proportional size, and have the proper folded or cleft structure; so that there can hardly be a doubt that they are functionally perfect. As we thus see that both the male and female organs are apparently perfect, *Myanthus barbatus* may be considered as the hermaphrodite form of the same species, of which the *Catasetum* is the male, and the *Monachanthus* the female.

It is not a little singular that the hermaphrodite *Myanthus* should resemble in its whole structure much more closely the male forms of two distinct species (namely *C. saccatum* and, more especially, *C. callosum*) than either its own male or female forms.

Finally, the genus *Catasetum* is interesting in an unusual degree in several respects. The separation of the sexes is unknown in other Orchids, excepting probably in the allied genus *Cycnoches* and in one other member of the *Vandeæ*, namely, *Acropera*. In *Catasetum* we have three sexual forms, generally borne on separate plants, but sometimes mingled together; and these three forms are wonderfully different from each other—much more different than, for instance, a peacock is from a peahen. But the appearance of these three forms on the same plant now ceases to be an anomaly, and can no longer be viewed as an unparalleled instance of variability.

Still more interesting is this genus in its mechanism for fertilization. We see a flower patiently waiting, with its antennæ stretched forth in a well-adapted position, ready to give notice whenever an insect puts its head into the cavity of the labellum. The female *Monachanthus*, not having pollinia to eject, is destitute of antennæ. In the male and hermaphrodite forms, namely *Catasetum* and *Myanthus*, the pollinia lie doubled up like a spring, ready to be instantaneously shot forth when the antennæ are touched. The disk end is always projected foremost, and is coated with viscid matter, which quickly sets hard and firmly affixes the hinged pedicel to the insect's body. The insect flies from flower to flower, till at last it visits a female or hermaphrodite plant; it then inserts one of the balls of pollen into the stigmatic cavity. When the insect flies away, the elastic caudicle, made weak enough to yield to the viscidity of the stigmatic surface, breaks, and leaves behind the pollen-mass; then the pollen-tubes slowly protrude, penetrate the stigmatic canal, and the act of fertilization is completed. Who would have been bold enough to surmise that the propagation of a species should have depended on so complex, so apparently artificial, and yet so admirable an arrangement?

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## Notice of a Collection of Algæ made on the North-West Coast of North America, chiefly at Vancouver's Island, by David Lyall, Esq., M.D., R.N., in the years 1859–61. By W. H. Harvey, M.D., F.R.S. & L.S., Professor of Botany in the University of Dublin, &c.

[Read February 20, 1862.]

Several parcels of Algæ, collected by Dr. David Lyall on the coasts of Vancouver's Island and in the neighbouring seas, and communicated by him to the herbarium at Kew, have been placed in my hands for determination. In the subjoined descriptive catalogue I have given the results of my examination, and shall merely preface the technical matter by a few general observations.

The whole number of species ascertained is 107, of which 100 are marine, and 7 freshwater species. The latter are as follows:—

A Vaucheria (*undeterminable*).
Batrachospermum moniliforme.
Cladophora glomerata.
Conferva rivularis.
Conferva floccosa.
A Zygnema (*undetermined*).
Hydrurus penicillatus.

All of these (including probably the undeterminable ones) are also British, and only one of them, *Hydrurus penicillatus*, is of local distribution. Dr. Lyall's specimens of this plant are of small size; but at Santa Fé, in New Mexico, Mr. Fendler has collected it in great abundance and of gigantic size, his specimens being sometimes two feet in length.

Of the 100 marine Algæ, *eleven* are either new species or well-marked new forms to which I have given specific names, namely these:—

Agarum fimbriatum, *H.*
Laminaria apoda, *H.*
Ectocarpus oviger, *H.*
Rhodomela Lyallii, *H.*
Polysiphonia senticulosa, *H.*
Hymenena latissima, *H.*
Cystoclonium gracilarioïdes, *H.*
Callophyllis flabellulata, *H.*
Prionitis Lyallii, *H.*
Schizymenia coccinea, *H.*
Callithamnion subulatum, *H.*

Of these the most remarkable is *Laminaria apoda*, which differs, as its name imports, from all other species of *Laminaria* in absolutely wanting a stipes. In other species, indeed, the stipes varies from less than half an inch to 12–15 feet in length; but in all cases a more or less obvious stipes interposes between the root and the lamina, and the new portion of frond grows between the apex of the stipes and the base of the lamina. In our *L. apoda* the stipes is represented by a basal callosity or thickening of the lamina, from which a fascicle of fibrous branching roots directly springs. Dr. Lyall has sent numerous specimens of various ages and sizes, and all have precisely similar characters; I do not doubt, therefore, that this is a well-marked and limited form. The nearest approach to *L. apoda* that I have seen occurs in some of the shorter-stemmed varieties of *L. dermatodea*; but I am not possessed of any specimen which could be regarded as intermediate.

I am not so confident of the distinctness of my *Agarum fimbriatum* from *A. pertusum*. The fimbriated character is not a very certain one; for it occurs occasionally in Algæ when developed under unusual circumstances; or it may arise from proliferous growth, after wounding at an early age. More specimens, and specimens of various ages, are required fully to establish this species.

Of *Hymenena latissima* many specimens were collected, but comparatively few of them were of adult age. The younger are undistinguishable from some *Nitophylla* in structure, the generic distinction not generally becoming obvious till fruit begins to be formed. Then the long lines of tetraspores are obviously separated by immersed and anastomosing veins, as in the original *H. fissa*, from which species and from *H. fimbriata* our plant is quite distinct.

Of the other new species, *Callophyllis flabellulata* is remarkable for closely simulating *Euthora cristata*; *Prionitis Lyallii* for its extraordinary variations in ramification and size; and *Callithamnion subulatum* for combining the characters of *C. americanum* and *C. floccosum*.

The species peculiar to the North-west Coast of America are 32, of which 7 are Melanosperms and 25 Rhodosperms, viz.—

Cystophyllum Lepidium, *P. & R.*
Phyllospora Menziesii, *Ag.*
Nereocystis Lütkeanus, *P. & R.*
Alaria marginata, *P. & R.*
Agarum fimbriatum, *H.*
Laminaria apoda, *H.*
Ectocarpus oviger, *H.*

——

Rhodomela Larix, *Ag.*
R. floccosa, *Ag.*
R. Lyallii, *H.*
Polysiphonia Californica, *H.*
P. senticulosa, *H.*
Amphiroa Californica, *Dcne.*
Hymenena fimbriata, *P. & R.*
H. latissima, *H.*
Rhabdonia Coulteri, *H.*
Rhodymenia pertusa, *Ag.*
Cystoclonium gracilarioïdes, *H.*
Callophyllis flabellulata, *H.*
Constantinea Sitchensis, *P. & R.*
Gigartina mollis, *Bail. & Harv.*
Chondrus affinis, *H.*
Endocladia muricata, *Ag.*
Halosaccion Hydrophora, *J. Ag.*
Prionites Lyallii, *H.*
P. lanceolata, *H.*
Schizymenia Mertensiana, *P. & R.*
S. coccinea, *H.*
Microcladia Coulteri, *H.*
M. borealis, *P. & R.*
Ptilota Californica, *P. & R.*
Callithamnion subulatum, *H.*

The following, from among the peculiar North-west American species are "represented" by allied species in other seas, viz.—

Phyllospora Menziesii, by Phyllospora comosa, in Australia.
Alaria marginata, by Alaria esculenta, in Europe.
Rhodomela Larix, by Rhodomela lycopodioïdes, in Europe.
Hymenena fimbriata, by Hymenena fissa, at the Cape of Good Hope.
Rhodymenia pertusa, by Rhodymenia polymorpha, in Australia.

Callophyllis flabellulata, by Callophyllis coccinea, *var.* pusilla, in Australia.
Constantinea Sitchensis, by Constantinea Rosa marina, Kamtskatka.
Chondrus affinis, by Chondrus crispus, in Europe.
Halosaccion Hydrophora, (an *analogous* species to) Gloiosaccion Brownii, in Australia.
Prionitis Lyallii, by Prionitis crinita, in Kamtskatka.
Callithamnion subulatum, by Callithamnion floccosum, in Europe.

The following 43 species are common to the Atlantic Coasts of North America, and those marked with an asterisk are peculiarly American:—

*Fucus furcatus, *Ag.*
F. vesiculosus, *L.*
Desmarestia viridis, *Lx.*
D. aculeata, *Lx.*
*Alaria Pylaii, *Grev.*
Laminaria saccharina, *Ag.*
*L. dermatodea, *De la Pyl.*
L. fascia, *Ag.*
Striaria attenuata, *Grev.*
Chorda lomentaria, *Lgb.*
Ectocarpus siliculosus, *Lgb.*
E. littoralis, *Lgb.*
Odonthalia angustifolia, *Suhr.*
*Chondria atropurpurea, *H.*
Polysiphonia atrorubescens, *Grev.*
P. urceolata, *Grev.*
Corallina officinalis, *L.*
Delesseria Hypoglossum, *Ag.*
D. alata, *Ag.*
Gracilaria confervoïdes, *Grev.*
Plocamium coccineum, *Lyngb.*
Rhodymenia palmata, *Grev.*
Rhodymenia Palmetta, *Grev.*
Ahnfeldtia plicata, *Ag.*
Callophyllis laciniata, *Kg.*
Gigartina mamillosa, *Lx.*
Halymenia ligulata, *Ag.*
Gloiosiphonia capillaris, *Carm.*
Ceramium rubrum, *Ag.*
C. diaphanum, *Ag.*
C. tenuissimum, *Ag.*
Callithamnion polyspermum, *Ag.*
*C. Americanum, *H.*
C. floccosum, *Ag.*
Porphyra vulgaris, *Ag.*
Enteromorpha compressa, *Lk.*
E. intestinalis, *Lk.*
Ulva latissima, *Ag.*
U. Linza, *L.*
Cladophora arcta, *H.*
C. glaucescens, *Griff.*
C. lætevirens, *Kg.*
Hormosira Carmichaëlii, *Kg.*

The following 45 are natives of the British Islands, and generally of the Atlantic Coasts of Europe; those marked with an asterisk have not yet been found on the Atlantic Coast of America:—

Fucus vesiculosus, *L.*
Desmarestia viridis, *Lx.*
D. aculeata, *Lx.*
*D. ligulata, *Lx.*
*Carpomitra Cabreræ, *Kg.*
Laminaria saccharina, *Ag.*
L. fascia, *Ag.*
Striaria attenuata, *Grev.*
Chorda lomentaria, *Lx.*
Ectocarpus littoralis, *Lgb.*
E. siliculosus, *Lgb.*
Polysiphonia atrorubescens, *Grev.*
P. urceolata, *Grev.*
*Laurencia pinnatifida, *Lx.*
Corallina officinalis, *L.*
Delesseria Hypoglossum, *Ag.*
D. alata, *Ag.*
Gracilaria confervoïdes, *Grev.*

Plocamium coccineum, *Lyngb.*
Rhodymenia palmata, *Grev.*
R. Palmetta, *Grev.*
Ahnfeldtia plicata, *Ag.*
Callophyllis laciniata, *Kg.*
*Kallymenia reniformis, *Ag.*
Gigartina mamillosa, *Ag.*
Halymenia ligulata, *Ag.*
*Schizymenia Dubyi, *Ag.*
Gloiosiphonia capillaris, *Carm.*
Ceramium rubrum, *Ag.*
C. diaphanum, *Ag.*
C. tenuissimum, *Ag.*
*Callithamnion Arbuscula, *Lgb.*
Callithamnion polyspermum, *Ag.*
*C. thujoideum, *Ag.*
C. floccosum, *Ag.*
*Codium tomentosum, *Ag.*
Porphyra vulgaris, *Ag.*
Enteromorpha compressa, *Lk.*
E. intestinalis, *Lk.*
Ulva latissima, *Ag.*
U. Linza, *L.*
Cladophora arcta, *H.*
C. glaucescens, *Griff.*
C. lætevirens, *Kg.*
Hormosira Carmichaëlii, *Kg.*

The two following are natives of the Mediterranean Sea, but not of the British Isles nor of the Atlantic Coasts of Europe:—

Amphiroa palmata, *Kg.*
Ulva fasciata, *Del.*

The following 20 are found on the West Coast of South America; those marked with an asterisk are also British:—

*Desmarestia viridis, *Lx.*
Macrocystis pyrifera, *Ag.*
*Laminaria saccharina, *Ag.*
*Chorda lomentaria, *Grev.*
*Ectocarpus siliculosus, *Lyngb.*
Polysiphonia dendroïdea, *Mont.*
*Corallina officinalis, *L.*
*Gracilaria confervoïdes, *Grev.*
*Plocamium coccineum, *Lyngb.*
Rhodymenia corallina, *Bory.*
*Ahnfeldtia plicata, *Ag.*
Callophyllis variegata, *Kg.*
Gigartina radula, *Ag.*
Iridæa cordata, *Bory.*
*Ceramium rubrum, *Ag.*
*C. diaphanum, *Ag.*
*Codium tomentosum, *Ag.*
*Porphyra vulgaris, *Ag.*
*Enteromorpha compressa, *Ag.*
*Ulva latissima, *Ag.*

The following 20 are common to Australia; those marked with an asterisk are also British:—

*Desmarestia ligulata, *Lgb.*
*Carpomitra Cabreræ, *Kg.*
Macrocystis pyrifera, *Ag.*
*Chorda lomentaria, *Grev.*
*Ectocarpus siliculosus, *Lgb.*
*Amphiroa corymbosa, *Lx.*
*Corallina officinalis, *L.*
*Gracilaria confervoïdes, *Grev.*
*Plocamium coccineum, *Lgb.*
Gigartina radula, *Ag.*
*Halymenia ligulata, *Ag.*
Ceramium cancellatum, *Ag.*
*C. rubrum, *Ag.*
*C. diaphanum, *Ag.*
*C. tenuissimum, *Ag.*
*Codium tomentosum, *Ag.*
*Porphyra vulgaris, *Ag.*
*Enteromorpha compressa, *Ag.*
*Ulva latissima, *Ag.*
Ulva rigida, *Ag.*

From the foregoing lists it appears, taking Dr. Lyall's collections for a fair specimen of the marine botany of Vancouver's Island, that, 1st. There are no local species of *Chlorospermeæ.* The few species that were found by Dr. Lyall are all plants of very wide distribution.

2nd. The species of *Melanospermeæ* and *Rhodospermeæ* that are peculiar to the North-west Coast of America amount to about one-third of the whole number collected.

3rd. About one-third of these peculiar species have representatives in other countries; namely, four in Australia, four in Europe, two in North-eastern Asia, and one at the Cape of Good Hope.

4th. Forty-three per cent. of the whole number collected are common to the East Coast of North America, 45 per cent. to the Atlantic Coasts of Europe, 20 per cent. to the West Coast of South America, and 20 per cent. to the Australian shores. This comparison shows that there is greater affinity between the marine vegetation of the Western Coasts of America and of Europe than between the Western and Eastern Coasts of America.

5th. Out of those common to West and East America, all except six are also British; while of those common to West America and to Britain, eight have not yet been recorded from the East Coast of America.

6th. Of those common to South America, three-sevenths are also British; and of those common to Australia, four-fifths are British. But of those species which are common to Britain and either to South America or to Australia, all but one (*Carpomitra Cabreræ*) are so widely diffused that they may be regarded as almost cosmopolitan.

On the whole, the collection does not give evidence of a very extensive marine flora, but rather of a vegetation abounding in species of larger and coarser growth, and deficient in those delicately organized species which frequent shallow bays and estuaries. The most remarkable and characteristic of the Vancouver-Island Algæ are the *Laminariaceæ*, many of which are of such gigantic size that full-grown specimens can hardly be expected ever to be seen in Europe. The *Nereocystis* has a stipes said to attain the length of 300 feet. The *Alariæ* probably have fronds of 20 to 30 feet in length—an enormous size for an undivided lamina of cellular tissue; and the *Costaria* and *Agarum*, though much smaller, still reach dimensions which appear extraordinary when compared with the dwarfer Laminarioid plants of the British shores. The selecting of herbarium specimens, characteristic without being inconveniently large, of such unwieldy objects is no easy task; and Dr. Lyall deserves thanks and praise for the manner in which he has performed it, nor less for the great care with which he has preserved all his specimens, the minute localization of each, and the pains bestowed in furnishing extensive suites of each species. So variable are some of these Algæ in form, that, without examining long suites of specimens of different sizes and ages, it would be difficult or impossible to say what was a species and what a variety. Even with the ample materials supplied to me by Dr. Lyall, I fear that I have not in every case succeeded in unravelling this tangle.

## MELANOSPERMEÆ.

1. Fucus vesiculosus, *var.* evesiculosus, *J. Ag. Sp. Alg.* i. 210.
Common between tide-marks. Vancouver's Island; Esquimalt and Victoria Harbours.

A narrower form on the outer sea-coast; a broader within the harbour. Also a very dwarf form from the outer sea-coast, 1–2 inches high, once-forked and fruiting; very similar to the dwarf variety from the Canary Islands, described by Montagne, 'Crypt. Canar.'

2. Fucus furcatus, *Ag.*? *Ic.* t. 14; *J. Ag. Sp. Alg.* i. p. 209.
Between tide-marks. Esquimalt; Vancouver's Island.

Of Agardh's plant I have seen no authentic specimen. Dr. Lyall's specimens differ from *F. vesiculosus*, var. *evesiculosus*, chiefly in the more immersed, less defined midrib, the uniformly narrower frond, 2–3 lines, rarely 4 lines wide, and the more slender, compressed, not turgid receptacles. My *F. Wrightii*, from Japan, scarcely differs. I fear that neither ought to be regarded as other than local varieties of *F. vesiculosus*, which sometimes, even in Europe, occurs with as narrow fronds. The elder Agardh's figure, above quoted, is worthless as a guide to the species described by J. Agardh.

3. CYSTOPHYLLUM LEPIDIUM (*Rupr.*). Caule crasso brevi, frondibus elongatis teretibus (crassiusculis) inermibus pinnato-ramosissimis, ramis undique egredientibus geminatis sparsisque basi sæpe foliosis, foliis lineari-lanceolatis enerviis planis acutis, ramulis vesiculiferis subcorymbosis, vesiculis sub apice ramuli indivisi solitariis ovalibus mucronatis, receptaculis .............. ?—*Cystoseira Lepidium, Rupr. Alg. Mar. Ochotzk,* p. 155.
On rocks below low-water mark. Entrance of Esquimalt Harbour; also dredged in 14 fathoms at St. Juan Island, 48° 30′ N., 132′ W.

Stem 2–3 inches long. Fronds numerous, closely inserted, 2–3 feet long, 1–1½ line in diameter, in outline of branches lanceolate. Lateral branches 4–6 inches long, in pairs or irregularly scattered, patent, sub-bipinnate; the lower pinnules leaf-bearing, the upper vesiculiferous, each ramulus having a vesicle below its apex. Vesicles 1–1½ line long, like the pods of some *Lepidium*. No fruit on our specimens, which quite agree with those distributed by Dr. Ruprecht, from the Sea of Ochotzk. Though nearly allied to *C. geminatum*, J. Ag., it appears to be distinct.

4. Phyllospora Menziesii, *Ag.*; *Harv.*; *Ner. Bor. Amer.* i. p. 62, t. 3. f. B.

Rocks at low tide, outer sea-coast; Esquimalt and Fuca Strait. *Dr. Lyall & C. Wood.*

5. Desmarestia viridis, *Lamour.*; *Ner. Bor. Amer.* i. p. 77.

Rocks below low-water mark; Esquimalt Harbour and Fuca Strait, *Dr. Lyall*; cast ashore, Esquimalt, *C. Wood*; dredged in 6–8–10 fathoms *Dr. Lyall & C. Wood.*

6. Desmarestia aculeata, *Lamour.*; *Ner. Bor. Amer.* i. p. 78.

Rocks at low water; Esquimalt Harbour, and dredged in 8–10 fathoms, *Dr. Lyall & C. Wood.*

7. Desmarestia ligulata, *Lamour.*; *Ner. Bor. Amer.* i. p. 78.

Rocks below low-water mark; Esquimalt Harbour, *Dr. Lyall & C. Wood*; Burrard's Inlet, Br. Columbia, *C. Wood*; dredged in 10 fathoms in sea water, sp. gr. 1·016, a low sp. gr. caused by admixture of water from the melted snows of the surrounding mountains. Sp. gr. in Straits of Georgia, 1·026, *C. Wood.*

Some of the specimens are of ordinary breadth; others are of the widest variety constituting the *D. herbacea* of authors (*Fucus herbaceus*, *Turn.* t. 99).

8. Carpomitra Cabreræ, *Kütz*; *Harv. Phyc. Brit.* t. 14.

Fuca Strait, *Dr. Lyall.*

A new and unexpected habitat for this local plant. Dr. Lyall's solitary specimen is in fruit, and does not materially differ from British specimens.

9. Macrocystis pyrifera, *Ag.*; *Harv.*; *Ner. Bor. Amer.* i. p. 84.

Fuca Strait and outer sea-coast; Esquimalt, *Dr. Lyall.*

10. Nereocystis Lütkeana, *Post. & Rupr. Illustr.* t. 8, 9; *Ner. Bor. Amer.* i. p. 85.

Rocks at low water; Esquimalt and Fuca Strait, *Dr. Lyall*; dredged in Burrard's Inlet, in 10 fathoms, *C. Wood.*

Besides a large specimen sent in a cask to the Kew Museum, Dr. Lyall has communicated numerous well-dried herbarium specimens of the young plant, which well illustrate the progressive development of the frond. The youngest specimen sent has a stem two inches long, tipped by a bulbous vesicle 2–3 lines in diameter, carrying at its summit two falcate-lanceolate leaves, which show a tendency to split from the base upwards, the line of future separation being indicated nearly to the middle of each leaf. In the next stage the stem has grown but little; but the apical bulb has attained the diameter of 4–5 lines, and the two leaves have, by medial splitting, become four, of which two are perfectly free, and two still connate for a short space near the base—thus showing (as is also more clearly seen in older plants) that the fissure takes place both from the base upwards and from the apex downwards. Other specimens, in which the stem is 6–8 inches long, the bulb 1–1½ inch in diameter, and the leaves 14-16 inches long, are not more advanced in subdivision than the first here described. The age and size at which splitting begins probably depend on the depth at which a specimen grows, those in shallow water beginning to divide at an earlier age. All after-growth consists in the lengthening of the stem till it reaches from 200 to 300 feet, in the increasing size and hollowing out of the apical vesicle till it becomes six feet or more in length, and in the multiplication of leaves, by continual bisection, until there results a huge, geminate tuft of foliage, always separated at base into two distinct bundles by the true apex of the vesicle, from which no leaves spring. Eventually each leaf is 20–30 feet long. In Dr. Lyall's larger herbarium specimens there are eight leaves, each partially bisected.

11. Alaria Pylaii, *Grev.*; *Harv.*; *Ner. Bor. Amer.* i. p. 89.

On stones at the mouth of the Esquimalt Harbour and St. Juan de Fuca, *Dr. Lyall & C. Wood.*

Most of the specimens are immature. The few that produce pinnæ have them broadly obovate, broader in proportion to their length than on specimens from Newfoundland. In other respects the plants agree.

12. Alaria marginata, *Post. & Rupr.?* *Harv.*; *Ner. Bor. Amer.* i. p. 89.

Esquimalt Harbour, &c.

The specimens are immature, without pinnæ, though some are of large size, 5–6 feet long. Even in the youngest state, this differs from the preceding by the very broad midrib, 1–1½ inch wide in fronds where the stipes is 3–4 lines wide; and half-an-inch wide in younger fronds, with stipes two lines wide.

13. Costaria Turneri, *Grev.* (C. Turneri *and* C. Mertensii, *J. Ag. Sp. Algæ*, i. p. 139, 140; *Harv.*; *Ner. Bor. Amer.* i. p. 90.)
Rocks at low water; Fuca Strait and Esquimalt, *Dr. Lyall.*

The numerous and beautifully preserved specimens sent vary with fronds *cordate-ovate, ovate, ovato-lanceolate,* and *lanceolate,* these forms passing insensibly one into another. The largest sent by Dr. Lyall are upwards of a foot wide and 2½ feet long, and are frequently perforated toward the base. When full-grown, the fronds measure 10–12 feet in length.

14. AGARUM FIMBRIATUM, n. sp. Stipite compresso-plano demum fimbriato-pinnato, costa latiore continuato, lamina membranacea bullata hic illic foraminibus irregularibus raris pertusa, basi subcordata, margine crispato eroso-fimbriato.
Dredged in 4–10 fathoms; Esquimalt Harbour, *Dr. Lyall & C. Wood.*

Stipes 1–2 inches long, flattened, 3–4 lines wide, at first simple, afterwards pinnated with horizontally patent, root-like, subulate processes, continued through the frond as an immersed costa, 4–6 lines wide. Fronds 2–3 feet long, 1–1½ wide, cordate at base; the margin strongly curled, and in all the older specimens jagged and fimbriated with irregular excurrent processes. The younger fronds are very much blistered (bullated), but have few foramina. The older are irregularly perforated with holes of unequal size and different shape, more abundant toward the margin. This must be near *A. pertusum*, P. & R., but differs in the fimbriated margin and stipes, if these be constant characters. More specimens are needed to ascertain this point.

15. Laminaria saccharina, *Ag.*; *Harv.*; *Ner. Bor. Amer.* i. p. 92.
Esquimalt Harbour, &c., common, *Dr. Lyall.*

Of this common plant many varieties are sent; some with very broad, others with narrow fronds, both varying greatly in proportionate length to breadth. Some have *strictly ovate* fronds, not more than once and a half as long as broad; others *ovato-lanceolate*, four times as long as broad; and others *lanceolate* and *linear-lanceolate*, many times as long as broad. One has a nearly *orbicular* frond! The substance varies from membranous to coriaceous, and the colour from olive-green to dark brown.

16. Laminaria dermatodea, *De la Pyl.*; *Ner. Bor. Amer.* p. 92.
Fuca Strait and Esquimalt, *Dr. Lyall & C. Wood.*

A series of specimens, young and mature. The younger and uncloven specimens differ from *L. saccharina* in their flattened, widened-upward stipe and less wavy frond; the mature ones from *L. digitata* in the stipe, &c.

17. LAMINARIA APODA, n. s. Stipite nullo!, lamina basi calloso-radicante late cordata coriacea demum apice in lacinias numerosas plus minus fissa v. omnino multipartita, radice ramosissima.

Rocks between tide-marks, Fuca Strait, *Dr. Lyall.*

Frond originating in a callus (or bulbiform stipe) attached to the rocks by many branching fibres, as in other species. Lamina sessile, a foot wide or more, 1-2 feet long (or more?), cordate at base, ovate or ovato-lanceolate in outline, coriaceous, at first probably undivided, but in all our specimens more or less split, as in *L. digitata.* Some are cleft quite to the base into many narrow segments. A very remarkable species, characterized by the absence of stipe, unless the hardened and thickened base of the lamina be so called. Some specimens of *L. dermatodea* have very short stipites, not more than half an inch long; and such serve to link our present plant with the stipitate species.

18. Laminaria fascia, *Ag.*; *Harv. Ner. Bor. Amer.* i. p. 91.
Esquimalt and Fuca Strait, *Dr. Lyall & C. Wood.*

19. Striaria attenuata, *Grev.*; *Harv. Ner. Bor. Amer.* (*Suppl.*) iii. p. 123.
Orcas Island, Vancouver, *Dr. Lyall.*

20. Chorda lomentaria, *Grev.*; *Harv. Ner. Bor. Amer.* i. p. 98.
In rock-pools, Esquimalt and Fuca Strait, *Dr. Lyall.*

21. ECTOCARPUS OVIGER, n. sp. Filis (3-5-uncialibus) decomposito-ramosissimis viridibus, ramis ramulisque alternis v. secundis erectis, ultimis longiusculis vagis, sporis ovoideis ad ramos subsessilibus sæpe secundis.

*Hab.* Stems of *Nereocystis*; Esquimalt, *Dr. Lyall.*

This has the aspect of *E. littoralis*, Ph. Br. (*E. firmus*, J. Ag.), but differs in the fruit, which is abundant in our specimens, and very like that of *E. granulosus*, from which our *E. oviger* differs in ramification.

22. Ectocarpus littoralis, *Ner. Bor. Amer.* i. p. 139.
On rocks and Fuci, Fuca Strait and Esquimalt, *Dr. Lyall & C. Wood.*

23. Ectocarpus siliculosus, *Lyngb.*; *Ner. Bor. Amer.* i. p. 139.
On stems of *Nereocystis*, Esquimalt, *Dr. Lyall.*

24. Ectocarpi sp.
Nanaimo, on rocks, *Dr. Lyall.*

Not in fruit, and overgrown with parasites; may be a var. of *E. littoralis.*

## RHODOSPERMEÆ.

25. Rhodomela larix, *Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 24.
On rocks and drifted, Fuca Strait; Point Roberts; Esquimalt; St. Juan de Fuca, *Dr. Lyall & C. Wood.*

26. Rhodomela floccosa, *Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 24.
Fuca Strait and Point Roberts, *Dr. Lyall & C. Wood.*

27. RHODOMELA LYALLII, n. sp. Fronde valde compressa elata decomposita pinnata disticha, pinnis pinnulisque in ambitu lanceolatis, ramulis subulatis alternis brevibus, ceramidiis ovatis subsessilibus stichidiisque racemulosis.
Adrift on the beach, Fuca Strait, *Dr. Lyall.*

12–20 inches high, regularly pinnate 3–4 times, all the divisions lanceolate (not corymbulose or fastigiate) in outline; the ramuli of the minor pinnules subequal, the lowest not conspicuously longer than the rest. In fruit, every ramulus of each ultimate plumule is generally converted into either a conceptacle or a stichidium, without any shortening of the rachis; hence the arrangement is racemulose, rather than corymboso-fasciculate, by which character, together with the larger size, more compressed frond, and more regular ramification, this plant differs from *R. floccosa.*

28. Odonthalia angustifolia, *Suhr.*?
On the beach, Esquimalt, *Dr. Lyall.*

29. Chondria atro-purpurea, *Harv. Ner. Bor. Amer.* ii. p. 22, t. 18. E.
Fuca Strait, *Dr. Lyall.*

30. Polysiphonia dendroidea, *Mont. Syllog.* p. 421, No. 1491; *Fl. Boliv.* p. 16, t. 5. f. 1.
Dredged in 10 fathoms, and cast ashore, Esquimalt, *Dr. Lyall.*

Nearly allied to *P. parasitica* and *P. pennata*, but more robust.

31. Polysiphonia atrorubescens, *Grev.*; *Harv. Ner. Bor. Amer.* ii. p. 40; *Ph. Br.* t. 172.
Esquimalt, and Fuca Strait, dredged in 10 fathoms, and cast ashore, *Dr. Lyall.*
Var. β. *minor.* Filis tenuioribus brevioribusque; Orcas Island, *Dr. Lyall.*

32. Polysiphonia Californica, *Harv. Ner. Bor. Amer.* ii. p. 48.
Esquimalt, &c., common, *Dr. Lyall.*

A very abundant species. The herbarium contains upwards of 100 specimens of all sizes, from 1 to 10–12 inches high. The more pinnated specimens pass, by slight changes, into the following. Perhaps all might be united with *P. gemmifera*, P. & R.

33. POLYSIPHONIA CALIFORNICA, var. β. PLUMIGERA. Filis rigidiusculis distanter ramosis, ramis primariis alternis infra longe nudis supra crebre alterne plumuligeris; plumulis bi- tri-pinnatis subfasti-

giatis, pinnulis ultimis flexuoso-alternis subulatis erecto-patentibus; articulis 14–16-siphoniis, ramorum diametro 8–12-plo v. multoties longioribus, ramulorum diametro æqualibus v. vix brevioribus.

Sandy beach near low water, Point Roberts, lat. 49° N., *Dr. Lyall.*

Filaments 5–6 inches long, flaccid, but not softening, sparingly divided into a few, long, naked primary branches, which sometimes have one or two small subulate ramuli below, and are closely set near the apex with bi-pinnate branchlets or plumules. Each plumule is 3-4 lines long and 2–3 broad, with a circumscribed outline. Colour, brown-red. A distinctly marked form, but not specifically different from the common *P. Californica.*

34. Polysiphonia urceolata, *Grev.*; *Harv. Ner. Bor. Amer.* ii. p. 32; *Ph. Br.* t. 167.

Esquimalt; Fuca Strait; Point Roberts: common.

35. POLYSIPHONIA SENTICULOSA, n. sp. Filis 2–3-uncialibus pellucide articulatis capillaribus mollibus cæspitosis siccitate badiis decomposite ramosissimis, ramis alternis secundisve bis terve divisis, secundariis strictis virgatis ramuliferis, ramulis brevibus subuliformibus alternis erecto-patentibus, articulis 4-siphoniis ramorum diametro 4–6-plo longioribus, ramulorum diametro æqualibus v. brevioribus.

Orcas Island, *Dr. Lyall.*

36. Laurencia pinnatifida, *Lamour.*; *Harv. Ner. Bor. Amer.* ii. p. 70; *Ph. Br.* t. 55.

Low-water rocks, St. Juan de Fuca Strait, *C. B. Wood*; Victoria Harbour, *Dr. Lyall.*

37. Amphiroa Californica, *Deane*; *Harv. Ner. Bor. Amer.* ii. p. 86.

Imbedded in roots of *Laminariæ*, Fuca Strait, *Dr. Lyall.*

38. Amphiroæ sp. indeterminata.

St. Juan de Fuca, S.W., *C. Wood*; Esquimalt, *Dr. Lyall.*

39. Amphiroa corymbosa, *Harv. Ner. Austr.* p. 99. t. 38.

Fragments only.

40. AMPHIROA (ARTHROCARDIA) EPIPHLEGNOIDES, *J. Ag. MSS.*, *fide Lenorm.* Fronde dichotoma v. vage ramosa flabelliformi, articulis difformibus, aliis oblongis vix compressis v. teretibus, aliis cuneatis v. polyhedris margine obtusis, ceramidiis paucis articulis latioribus insidentibus.—*A. rudis*, Harv. in Herb. D.C.D.

Rocks near low-water mark, Fuca Strait, *Dr. Lyall.*

3-4 inches long. Lower and some of the upper joints like those of *Corallina officinalis*; the medial generally broad, short, and compressed, triangular or oblate, always rounded at the edge. A native also of Tahiti.

41. CORALLINA OFFICINALIS, *L.*; *Harv. Ner. Bor. Amer.* ii. p. 83.

Rocks between tide-marks, Esquimalt, *Dr. Lyall.*

42. Delesseria hypoglossum, *var.* arborescens, *Lamour.*; *D. arborescens*, *De la Pyl.*
Fuca Strait, *Dr. Lyall.*

Fine specimens, not unlike some from the North of Ireland, or the "*D. arborescens*" of the French coast.

43. Delesseria alata, *Lamour.*, var. latissima.
On stems of *Nereocystis*, *Dr. Lyall.*

The fronds, though evidently not fully developed, are of extraordinary width; the broadest ½–¾ inch, the narrower ¼ inch wide.

44. Hymenena fimbriata, *P. & R.*; *Harv. Ner. Bor. Amer.* ii. p. 102.
On the beach, Victoria Harbour; Esquimalt, *Dr. Lyall & C. Wood.*

45. HYMENENA LATISSIMA, n. s. Fronde latissima, juniore flabelliformi, adulta vage partita v. laciniata infra venulosa sursum subavenia, laciniis latissime cuneatis v. flabellatis inciso-lobatis, lobulis rotundatis, cystocarpiis sparsis, soris totam frondem demum percurrentibus.
Esquimalt Harbour, dredged and adrift, *Dr. Lyall, C. Wood.*

Fronds 12–15 inches long and wide, variously cleft, the segments fan-shaped, cut at the apex into many, short, round-topped lobes. The lower half of the frond is traversed with many conspicuous, subparallel, anastomosing veins; the upper apparently nerveless, until the tetrasporic fruit is formed, when the interspaces of the sori indicate the lines of nervation; and in older specimens anastomosing nerves may be clearly traced, even to the extremities. Colour, a bright red. The herbarium contains specimens with both kinds of fruit; but the bulk of those sent are without fructification, and consequently not clearly distinguishable from a *Nitophyllum.*

46. Nitophylli? *v.* Hymenenæ species?
Victoria Harbour, in deep water, *Dr. Lyall.*

Specimens without fruit, much torn, and proliferous from the wounds, and therefore not determinable. Some look as if they belonged to *Nitophyllum laceratum*, and others like a divaricated state of *Hymenena.*

47. Gracilaria confervoides, *Grev.*; *Harv. Ner. Bor. Amer.* ii. p. 108.
Esquimalt, *Dr. Lyall.*

A deep-water variety, very much resembling, in ramification and aspects, our *Cystoclonium gracilarioides*, but quite distinct in structure.

48. Rhabdonia Coulteri, *Harv. Ner. Bor. Amer.* ii. p. 154, t. 23. B.
Esquimalt, *C. B. Wood.*

A single specimen, in fruit (*cystocarpia*).

49. Plocamium coccineum, *Lyngb.*; *Harv. Ner. Bor. Amer.* ii. p. 153.
Dredged in 6–8 fathoms, Esquimalt, *Dr. Lyall*; low-water rocks, Fuca Strait, *C. Wood.*

Apparently common; several specimens sent.

50. Rhodymenia pertusa, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 147.
Cast ashore, Point Roberts; and on rocks at low water, Fuca Strait, *Dr. Lyall.*

Fine specimens; some with *cystocarpia.*

51. Rhodymenia palmata, *Grev.*; *Harv. Ner. Bor. Amer.* ii. p. 148.
On rounded pebbles, on an exposed beach, Esquimalt, *Dr. Lyall.* Also cast ashore, and on rocks at low water, in Fuca Strait, *Dr. Lyall.*

Common, and quite like the ordinary broad-leaved European form.

52. Rhodymenia corallina, *Bory* ?
Dredged in 14 fathoms, St. Juan de Fuca, *Dr. Lyall.*

Fragments, apparently of this species.

53. Rhodymenia palmetta, *Grev.*; *Harv. Ner. Bor. Amer.* ii. p. 149.
Fuca Strait, on stones, *Dr. Lyall.*

A single specimen.

54. Ahnfeldtia plicata, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 168.
Esquimalt, and Fuca Strait, *Dr. Lyall.*

55. Gymnogongri species.
Esquimalt, *Dr. Lyall.*

One small specimen with *favellidia.* It agrees in several respects with *G. linearis* (*Turn. Hist. Fuc.* t. 220), but is much smaller and more ramulous, and may be distinct.

56. **Cystoclonium gracilarioides**, n. sp. Fronde longissima simpliciuscula crassa alterne v. vage v. secunde ramosa, ramis cylindraceis basi vix attenuatis simplicibus omnino nudis v. ramulos perpaucos ferentibus, cystocarpiis?
Dredged in 10 fathoms, Esquimalt Harbour, *Dr. Lyall.*

Fronds 12–18 inches long, 1–1½ lines in diameter; very like the cord-like varieties of *Gracilaria confervoides*, but with the cellular structure proper to *Cystoclonium.* Lateral branches numerous, 5–6 inches long, patent, quite simple, mostly naked, rarely with a few ramuli. Fruit a desideratum.

57. **Callophyllis flabellulata**, n. s. Fronde pusilla (1–4-unciali) flabelliformi coccinea subdichotome v. digitatim multipartita et fastigiata, laciniis linearibus raro cuneiformibus patentibus sensim an-

gustioribus, apicibus acutis, cystocarpiis in discum v. ad marginem laciniarum sessilibus.

Dredged in 8–10 fathoms, and cast ashore, Esquimalt, *Dr. Lyall.*

The smaller specimens so exactly resemble *Euthora cristata*, that it is difficult to persuade oneself, without dissection of frond and fruit, that they belong to a different genus. The larger look like small varieties of *Callophyllis variegata*, and yet are not identical; some very narrow ones are equally like the narrow and dwarf states of *C. coccinea*. The colour is a bright red. The substance is somewhat rigid, but very imperfectly adhering to paper. The average width of the segments is 1–2 lines.

58. Callophyllis variegata, *Kütz. Sp. Alg.* p. 745.

Open beach, Esquimalt, *Dr. Lyall.*

A few small specimens. They are less fastigiate and broader than *C. flabellulata*, with more cuneate and obtuse or truncate segments, and of much softer substance.

59. Callophyllis laciniata, *Kütz.*; *Harv. Ner. Bor. Amer.* ii. p. 171; *Ph. Br.* t. 121.

Esquimalt, *Dr. Lyall.*

Fragments only.

60. Constantinea Sitchensis, *Post. & Rupr.*; *Harv. Ner. Bor. Amer.* ii. p. 173.

Adrift on the beach, Victoria Harbour, *Dr. Lyall.*

Perhaps this is only a luxuriant state of *C. rosa-marina.* The lamina in our specimens is torn, but must have been 6–8 inches in diameter when perfect.

61. Kallymenia reniformis, *J. Ag. Sp. Alg.* ii. p. 286.

Dredged in Esquimalt Harbour, 10 fathoms, *Dr. Lyall.*

A single specimen.

62. Gigartina radula, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 178.

Fuca Strait and Victoria Harbour, *Dr. Lyall, C. Wood.*

63. Gigartina mamillosa, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 175.

Var. *α. vulgaris.* Repetite ramosa, laciniis angustis cuneatis linearibusve.

Var. *β. latissima.* Parce dichotoma, laciniis latissime cuneatis truncatis.

Esquimalt Harbour, *Dr. Lyall.*

Between the broadest and simplest and the narrower forms there seems a direct passage; nor can I distinguish such varieties, more than similar states of *Chondrus crispus.* I have seen no authentic specimen of Agardh's "*G. papillata*" (from the Sandwich Islands); but his description agrees well with the broader and simpler of the Esquimalt specimens.

64. Gigartina mollis, *Bail. & Harv.*; *Harv. Ner. Bor. Amer.* ii. p. 175.
Rocks at low water, Fuca Strait, and dredged in 5 fathoms, *Dr. Lyall.*

65. Chondrus affinis, *Harv. Ner. Bor. Amer.* ii. p. 181.
Esquimalt, *Dr. Lyall.*

66. Iridæa cordata, *J. Ag.*; *Turn. Hist.* t. 116; *Ner. Bor. Amer.* ii. p. 180.
Esquimalt and Fuca Strait: common, *Dr. Lyall.*

Many specimens, of various ages, extremely varied in form; some with strictly cordate base, and others gradually passing off toward the obovate basally attenuated form called *I. laminarioides.* Substance in the younger plants thin and glossy, bright purple; in the older thick and fleshy, dull red-brown.

67. Endocladia muricata, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 182, t. 28. B.
Rocks between tide-marks; Esquimalt, *Dr. Lyall*; in 5–9 fathoms, *C. Wood.*

68. Halymenia ligulata, *J. Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 192.
Esquimalt Harbour, 4–6 fathoms, *Dr. Lyall.*

Two specimens only; a broad, flat, nearly regularly dichotomous form.

69. Halosaccion hydrophora, *Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 194.
Esquimalt, on rocks and in tide-pools, *Dr. Lyall*; on floating wood, *C. Wood.*

Old fronds 10–12 inches long, 1–1½ inch in diameter. Injured specimens are frequently proliferous from the wound, or the broken sac throwing out numerous sacs from the side.

70. **Prionitis Lyallii**, n. sp. Fronde polymorpha membranaceo-coriacea siccitate badia sæpissime plana plus minus pinnatim et dichotome ramosa; nunc subsimplici lanceolata pinnis lanceolatis utrinque marginata; nunc ramosissima, ramis lineari-cuneatis, basi longe angustatis margine foliiferis pinnulatisve, pinnis ciliæformibus; nunc di-pollachotoma laciniis linearibus patentibus apicibus acutis v. explanatis.
Esquimalt, on tidal rocks and rock-pools, *Dr. Lyall*; Fuca Strait, *C. B. Wood.*

Between extreme states of this most variable species nothing but an extensive suite of specimens can suggest a connexion; and yet I find it impossible to fix limits to the following varieties:—

Var. *α. lanceolata.* Fronde 12–14 uncias longa, unciam lata, subsimplici lanceolata, pinnis minoribus foliaceis marginata et e disco prolifera.

Var. *β. ornata.* Caule compresso-filiformi tenui parce ramoso, ramis latissimis 6–8 uncias longis margine et disco foliiferis.

Var. *γ. normalis.* Fronde ramosissima digitato-pinnatim ramosa, ramis majoribus minoribusque lineari-cuneatis, basi angustatis, 2–4 uncias longis, 3–5 lineas latis, plus minus margine pinnulatis, pinnulis subhorizontalibus anguste linearibus v. apice dilatatis.

This seems to be the central or typical form of the species. The larger fronds are 12–14 inches in the expansion of the branches.

Var. δ. *densissima.* Fronde creberrime ramosissima pluries pinnatim ramosa, pinnis pinnulisque linearibus basi angustatis.

A narrower and more densely branched state than the preceding.

Var. ε. *intermedia.* Fronde ramosissima angustata, ramis superioribus plus minus dilatatis.

Between δ & ζ.

Var. ζ. *dilatata.* Fronde plus minus ramosa vix pinnulata, ramis superioribus dilatatis foliaceisve lanceolatis.

Var. η. *depauperata.* Parvula, debilis, sæpius di-pollachotoma et fastigiata.

Numerous other minor and connecting states might be named.

71. PRIONITIS LANCEOLATA? var. FILICINA. Fronde creberrime bi-tripinnata, pinnis pinnulisque horizontalibus.

On rocks, Esquimalt, *Dr. Lyall.*

Two specimens only. In substance, colour, and structure these specimens agree with the Californian *P. lanceolata,* than which, however, they are much more densely branched and more pinnated. I do not venture to propose them as specifically different.

72. Schizymenia Dubyi, *J. Ag.*; *Harv. Ph. Br.* t. 123.

On rounded pebbles, on an exposed beach, Esquimalt, *Dr. Lyall.*

Very similar to some of the larger English specimens.

73. Schizymenia Mertensiana, *P. & R.*? *J. Ag. Sp.* ii. p. 174.

Adrift, Victoria Harbour, *Dr. Lyall.*

A fragment only. The substance resembles parchment.

74. SCHIZYMENIA? COCCINEA, n. sp. Fronde..................maxima rubro-coccinea gelatinoso-membranacea tenui, siccitate chartæ arcte adhærente, structura laxa, filis medullaribus paucis arachnoideis.

Dredged in 14 fathoms, Griffin Bay, St. Juan Island, *Dr. Lyall.*

Fragments only, from which the outline can be but vaguely guessed at. The largest piece is about 16 inches long and a foot wide, and presents a bright-crimson, glossy, soft membrane closely adherent to paper. Its cellular structure is rather that of *Halymenia*; but the habit is more that of *Schizymenia,* where I provisionally place it.

75. Gloiosiphonia capillaris, *Carm.*; *Harv. Phyc. Bor.* t. 57.

On stems of *Nereocystis, Dr. Lyall.*

Two specimens only.

76. Microcladia Coulteri, *Harv. Ner. Bor. Amer.* ii. t. 33. A.
Rocks at low water, Esquimalt, *Dr. Lyall.*

77. Microcladia borealis, *P. & R.*; *Harv. Ner. Bor. Amer.* ii. p. 210.
Rocks at low water, Fuca Strait, *Dr. Lyall.*

78. Ceramium cancellatum, *Ag.*
Rocks and larger Algæ, at low water, Esquimalt, *Dr. Lyall.*

79. Ceramium rubrum, *Ag.*; *Ner. Bor. Amer.* ii. p. 213.
Esquimalt, *Dr. Lyall.*

80. Ceramium diaphanum, *Ag.*; *Ner. Bor. Amer.* ii. p. 215.
Rock-pools, Esquimalt and Port Roberts, *Dr. Lyall.*

81. Ceramium tenuissimum, *Ag.*; *Ner. Bor. Amer.* ii. p. 216. (C. nodosum, *Kütz.*)
Dredged in 10 fathoms, Esquimalt, *Dr. Lyall.*

82. Ptilota Californica, *Rupr.*; *Ner. Bor. Amer.* ii. p. 222.
Esquimalt, *Dr. Lyall.*

Fragments only, much battered.

83. Callithamnion arbuscula, *var.* Pacificum. (C. Pikeanum, *Harv. Ner. Bor. Amer.* ii. p. 230.)
Tidal rocks, Esquimalt, *Dr. Lyall.*

The specimens so nearly coincide with Orkney specimens of the European *C. arbuscula* that I cannot keep them specifically apart. The branching of the ramuli is less pectinate and more regularly pinnate than in the specimen from California on which my "*C. Pikeanum*" was founded.

84. Callithamnion polyspermum, *Ag.*; *Harv. Ner. Bor. Amer.* ii. p. 234.
On rocks, Esquimalt, *Dr. Lyall.*

85. Callithamnion thuyoideum, *Ag.*; *Phyc. Brit.* t. 269.
On dead shells, in 10 fathoms, Esquimalt, *Dr. Lyall.*

There are several specimens of this elegant species, very closely similar to those from the West of Ireland, in Herb. T. C. D. One of Dr. Lyall's shows a tendency to pass into "*C. tripinnatum*" or *C. gracillimum.*

86. Callithamnion Americanum, *Harv. Ner. Bor. Amer.* p. 238, t. 36. A.
On stems of *Nereocystis*, and dredged in 8–10 fathoms, Esquimalt, *Dr. Lyall.*

87. CALLOTHAMNION SUBULATUM, n. sp. Fronde rigidiuscula erecta alterne decomposita ramosissima, ramis ramulisque opposite pinnatis; pinnis subulatis acutissimis, junioribus nudis, adultis basi intus ramulo multifido auctis demum fasciculato-ramulosis; tetrasporis triangule divisis ad ramulos secundarios sessilibus.
On small stones, sandy beach, Esquimalt, *Dr. Lyall.*

More rigid than *C. Americanum*, but seemingly intermediate between the less ramulose states of that species and the following. The larger are 6–8 inches long and broad, their divisions having a pyramidal outline.

88. Callithamnion floccosum, var. pacificum. Pinnis omnibus longis filiformi-subulatis simplicissimis.
On stems of larger Algæ, Orcas Island and Esquimalt, *Dr. Lyall.*

Much more densely branched and with much longer pinnæ than the usual Atlantic variety, and with more the aspect of *C. Americanum*; but some Scotch specimens in Herb. T. C. D., by the length of their pinnæ and general habit, come near the present.

## CHLOROSPERMEÆ.

89. Codium tomentosum, *Harv. Ner. Bor. Amer.* iii. p. 29.
Esquimalt Harbour, &c., on rocks, *Dr. Lyall.*

90. Porphyra vulgaris, *Ag.*; *Ner. Bor. Amer.* iii. p. 53.
On rocks and Algæ, Esquimalt, &c., common.

Several varieties. Some are 3–4 feet long, and 1 foot wide; others are beautifully marbled with green and purple.

91. Enteromorpha compressa, *Link*; *Harv. Ner. Bor. Amer.* iii. p. 57.
On rocks and dredged, Esquimalt, &c., very common.

92. Enteromorpha intestinalis, *Link*; *Ner. Bor. Amer.* iii. p. 57.
Strait of Georgia, in 8 fathoms, *C. B. Wood.*

93. Ulva latissima, *Linn.*; *Ner. Bor. Amer.* iii. p. 59.
Esquimalt, &c., common.

94. Ulva fasciata, *Del.*; *Ner. Bor. Amer.* iii. p. 58.
Pools between tide-marks, outer sea-coast and adrift, *Dr. Lyall.*

95. Ulva rigida, *Ag.*
Esquimalt, *Dr. Lyall.*

96. Ulva Linzæ, *Ag.*; *Ner. Bor. Amer.* iii. p. 59.
Rock-pools, Esquimalt and Orcas Island, *Dr. Lyall.*

97. Vaucheriæ sp.
In running streams, Esquimalt and Lake Schweltza, *Dr. Lyall.*

The species is not determinable from dried specimens.

98. Batrachospermum moniliforme, *Ag.*
Stones in running streams, Chilukweynk Valley, *Dr. Lyall.*

99. Cladophora arcta, *Phyt. Br.* t. 135; *Ner. Bor. Amer.* iii. p. 75.
Orcas Island, Esquimalt, &c., *Dr. Lyall & C. Wood.*

100. Cladophora glaucescens, *Griff.*; *Ner. Bor. Amer.* iii. p. 77.
Nanaimo, Vancouver's Island, *C. Wood.*

101. Cladophora lætevirens, *Dillw.*; *Ner. Bor. Amer.* iii. p. 82.
Fuca Strait, *Dr. Lyall.*

Young specimens, about an inch in height.

102. Cladophora glomerata, *Linn.*; *Ner. Bor. Amer.* iii. p. 84.
Lake Scheveltza, *Dr. Lyall.*

103. Conferva rivularis, *Ag.*
In running streams, Sumas Prairie, Br. Columbia, *Dr. Lyall.*

104. Conferva floccosa, *Ag.*
In pools above high water, Esquimalt, *Dr. Lyall.*

105. Zygnematis sp.
Pools, Esquimalt.

A moderately robust species, with short joints.

106. Hormotrichum Carmichaelii, *Harv.*; *Ner. Bor. Amer.* iii. p. 90.
Rock-pools between tide-marks, Fuca Strait, *Dr. Lyall.*

107. Hydrurus penicillatus, *Ag.*; *Ner. Bor. Amer.* iii. p. 118.
On stones in streams, Chilukweynk Valley, *Dr. Lyall.*

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## On the Discovery of *Gladiolus Illyricus* (Koch) in the Isle of Wight. By ALEXANDER G. MORE, F.L.S.

[Read April 3, 1862.]

THROUGH the kindness of my friend the Rev. E. Venables, I have lately obtained the loan of a specimen and drawing of a wild *Gladiolus* gathered by a lady near Shanklin, in the Isle of Wight; and in answer to some inquiries addressed to her, Mrs. Phillipps, the discoverer, has informed me that it was found growing in the midst of a wild tract of copse and heath, called the "Apse" or "America" woods. Only one plant was noticed: it was in bud on the 7th of July 1855, and, having been carried home, afterwards flowered, when the drawing was made.

The *Gladiolus* found at Shanklin evidently belongs to the same species as that which grows in the New Forest, as I have ascertained by comparing Mrs. Phillipps's specimen with a series collected at Lyndhurst, by Mr. John T. Syme; but in the characters afforded by the stigma, whose lobes are suddenly (not gradually) enlarged upwards, the English plant from both localities appears to agree better with *Gladiolus Illyricus* (Koch) than with either *G. imbricatus* (Linn.) or *G. communis* (Linn.); and I therefore venture to propose a change of name, which, I am glad to say, has the approval of my friend Professor Babington, who further allows me to state that he finds the English *Gladiolus* to agree exactly with Continental specimens of *G. Illyricus* issued by C. Billot.

*Gladiolus communis* (Linn.) is a much larger plant, and is easily distinguished from the other two species by its larger flowers and much stouter leaves. The range also of *G. communis* appears to be more exclusively southern in Europe.

It will be remembered that Dr. Arnott, in the latest edition of the British Flora, treats "*Gladiolus communis*" as an introduced plant. Mr. Bentham, also in his 'Handbook,' writes, "Possibly accidentally introduced;" but I believe that the occurrence of *Gladiolus Illyricus* in the Isle of Wight supplies an important link in support of its being indigenous to Britain.

There can be no doubt as to the identity of the present specimen. Fortunately, the finder noted down the date in her journal at the time, and made a drawing of the plant while it was still fresh. Further, there is a tradition on the spot: it has long been known to the inhabitants of a neighbouring farm-house that a wild *Gladiolus* grows in the woods at Shanklin.

The specimen now exhibited was found in the middle of the wood, in a spot remote from cottages; nor am I aware that *G. Illyricus* is at all cultivated as a garden-flower.

The nature of the British stations (heaths and heathy woods) agrees perfectly with what is known of the place of growth of *G. Illyricus* in the north-west of France.

If *G. Illyricus* appears to belong to the south and west of Europe, its position in Britain is not unlike that of several other species which, though absent from North and Middle Germany, extend along the shores of the Atlantic as far as the British Isles. *Arum Italicum*, *Rubia peregrina*, *Cyperus longus*, *Agrostis setacea*, &c. will readily occur as examples of this; and no doubt all these plants are influenced by the comparative mildness of the maritime climate of the west of Europe.

If very rare in Hampshire and in the Isle of Wight, *G. Illyricus* is also said to be exceedingly scarce in the Loire district of France, as indeed might be expected from its outlying position in both countries, where we may suppose it to be at the extreme limit of its range.

It is hoped that any botanist who may succeed in discovering other plants at Shanklin will not fail to publish the details, since, however great the geographical probabilities of its wildness, it would be very desirable to have more than a single root to vouch for *Gladiolus Illyricus* being indigenous to the Isle of Wight.

# *Florula Mallica.* By M. P. Edgeworth, Esq., F.L.S.

[Read May 1, 1862.]

The paper which I now offer to the Society is the result of my botanical observations in the Multan division of the Punjab, where the Malli resided in the time of Alexander. During an official residence of five years, I have visited every portion of it, but unfortunately not always at the most favourable season for botany; therefore further explorations may add some other species to the somewhat meagre flora now to be described, particularly in the northern portion. It is, however, interesting as a region of botanic geography osculating between that of the North-west of India and that of Sindh and Arabia.

The Multan division, comprising the districts of Jhung, Gogaira, and Multan (15,494 square miles, of which only 1221 are cultivated), is a tolerably natural one as a botanical sub-section. It is triangular, bounded on the south by the Sutlej, on the west by the Jhilum and the Chenab after their junction, except for a short distance, where the boundary is the edge of the Sandy Desert (or Thall) of the Sind Sāgar Doab, on the north-east by an irregular line running from Kot Isa Shah across the Vichan Doab (often termed by us, though not by the inhabitants, the Chaj or Jech) to a little above Chandniot, and thence in a nearly straight line to the Sutlej, nearly opposite Mamdot. It thus embraces some of the detached hills which form the remarkable ranges which shoot up suddenly out of the plain, rising to the height of 1000 feet at Kirana in the Vichan Doab, and finally descend near Shahkot in the Rechnab. Those near Chandniot are about 400 feet, and at Shahkot not about 150. They consist of sandstone and slate, and are very barren.

Thus the division consists of the lower extremities of the three Doab—the Vichan, Rechnab, and Bari. We might include the Bīst also; but the total drying of the old Beas has obliterated that distinction, as obtained in the Ayin Akbari in the 16th century.

Each Doab consists of two distinct portions, the cultivated strip of low land bordering the rivers (Kăchhi) and the central higher land (*Bār*). This word appears to be a corruption of the Arabic *barr*, which is defined by Col. Chesney, in his 'Euphrates,' to be a dry desert of hard clay, more or less covered with bushes and grass. The term was probably applied by the Arab conquerors, who have left traces of their language in the village dialect, in several Arabic words not usually in the Urdū.

The Bār may further be considered as twofold; that more properly so called is raised some thirty to fifty feet above the lower land.

The Bār proper, when seen at the close of a favourable rainy season, is very pleasing—a rich carpet of grass dotted over with bushes or large trees, mostly *Salvadora* or *Tamarix*. The soil is hard, and in a few places there are dunes of blown sand (as in the Thall), and occasionally tracts of sodiferous soil which produces nothing almost but *Salsolaceæ*.

The Bār improper is intersected by the remains of deserted water-courses (arid branches of the several rivers). It is either densely clothed with a jungle of *Jhund* (*Prosopis*) or *Tamarix* both *orientalis* and *Gallica*, or consists of almost perfectly bare open tracts of clay, sometimes sodiferous, causing friable soil, the dust of which will fall like water in drops, sometimes with sand-dunes, generally thinly clothed with the grey *Anabasis multiflora*, which toward the Chenab seldom exceeds two feet in height, while towards the Sutlej it often is five or six, making a small bush with ramifications not unlike a miniature oak, and not unpleasing to the eye when in fruit, when the winged calyces are often of a bright rose-colour.

In the lower part of the Bari Doab, forming the district of Multan, the Bār is intersected by innumerable long, low mounds, the remains of ancient canals from the Ravi, Chenab, and Beyas, which, gradually silting up, have raised themselves above the level of the country, and finally, probably owing to the change of the course of the latter river, been quite deserted. Towards the south of the district there are several ranges of low dunes of drifting sand which have a peculiar vegetation of their own.

The *Kăchhi*, or irrigated portion of the district, produces very fine crops of cereals, sugar-cane, and indigo, particularly on the Chenab. There are also extensive groves of the date-palm, which was introduced by the Arabs in the eighth century. The usual weeds of cultivation appear in the winter, not only those common to the Punjab and North-west Provinces, but from Persia and Affghanistan, that do not cross to the Sutlej, as *Hypecoum* and *Goldbachia*. It is well wooded, principally with *Acacia Arabica* and *Lebek* (the former of enormous size and height) and *Dalbergia Zizyphus*. Wherever irrigation penetrates, the produce is very great; without it, very little will grow. In some places there are only wells for the purpose; but throughout the Kăchhi they have the advantage of inundation-canals from the rivers, which fill their water-courses about the beginning of May, just after the spring crop (Rabi) has been brought in. Consequently the cotton or millet is sown earlier than is the practice where they are dependent only on the rain-fall in June or July.

The climate is excessive, varying from 120° in the shade to 21°, the lowest that I have observed it. During winter, the temperature falls to the freezing-point every night that is clear. There are frequent showers during the season. Hail occasionally falls, principally in March or April. In May the hot winds commence. They blow from the south, instead of west or north-west as is the case in Hindostan. This wind continues more or less during the whole summer. The east wind is rare; but in some years heavy rain accompanies that wind, as in the North-west Provinces: on such occasions the "Bār" is clothed with verdure: but this cannot be depended upon, and for several years in succession there may be no rain-fall at that season; consequently the smaller semitropical annuals which abound in other parts of India are but rare, especially the *Acanthaceæ*.

Water-plants are extraordinarily rare, though there are so many stagnant and semi-stagnant branches of the rivers. I have observed but seven, two of them very rare (*Limnanthemum* and *Nymphæa*), while there is a total absence of the *Lentibulariæ*, *Alismaceæ*, *Naiades*, and *Charæ*, all of which abound in the region immediately to the north and west, so much so that the natives at Multan are unable to clarify their molasses, from the want of the "Jhanjh" or *Hydrilla*, and other *Naiades*, which are used for the purpose of "claying" in other parts of India.

The whole Phanerogamic flora is but 334, exclusive of 113 only cultivated.

There are 34 species riparious, including those which enjoy partial submergence.

There were 32 annual weeds of cultivation in the cold season (Rabi), 33 in the summer and autumn, including those which prevail at all seasons, being 9, 2, and 10 per cent. respectively.

Including all shrubs, trees, and woody climbers, I find but 43, being 13·3 per cent.

I find no less than 78 species peculiar to our deserts. Among these the following are collected by the poorer classes, especially the nomadic tribes who inhabit the "Bār." The women sweep up the fallen seeds by a whisk into straw baskets resembling our dust-pans. *Tribulus alatus*, *Zygophyllum simplex*, *Trianthema*, *Boerhaavia elegans*, *Agrostis scabrifolia*, *Panicum colonum* and *Hydaspicum*, *Cenchrus*, and *Pennisetum*.

It is a curious sight to see the numbers that go out from the villages into the desert to collect and eat the fruit of the *Salvadora oleoides*, called *Pīlū*, and the *Capparis* (*Sodada*) *decidua*.

The late Dr. Stocks kindly communicated to me a list of his Sindh flora: there are only 19 Mallic plants, or 94·3 per cent., not common to Sindh; there are 76, or 77·7 per cent., not observed in the cis-Sutlej States by myself in 1834–8. No less than 227, or nearly 65 per cent., are common to North Africa and Arabia; 83, or nearly 25 per cent., are European, while 73·3 per cent. are common to India proper, exclusive of the Punjab and Sindh. The most remarkable forms were *Pappophorus*, *Stipagrostis*, *Cressa*, *Frankenia*, *Limneum*, *Dipterygium*, and *Neuroda*.

Among the Cryptogamic flora we have but four, exclusive of fungi, *Marsilea*, an *Equisetum*, *Adiantum Capillus-Veneris*, and a *Phascum*. There are a few fungi found, and two of them are edible—one resembling a morel, called *Kumbha*, which is found in profusion in the Rechnab Desert, and which is much liked by the natives and those of my European friends who have had the opportunity of tasting it, which I myself have not. The other is subterraneous, found in cultivated land near Multan, and called *Boenphul*, or earth-fruit, which I do not at all like. Unfortunately my collection of fungi was lost; therefore I cannot enumerate the species.

Lastly, I may point out the paucity of species in this flora—only 338, exclusive of *Cellulares*, in an area exactly the half of Ireland (in which Dr. Mackay enumerates 1057 in his 'Flora Hibernica')—little more than what I collected in Banda, $\frac{1}{8}$th of its area. These species are distributed in 67 orders, exactly five, on an average, in each order; and in 226 genera, giving an average of 1·5 to each genus,—very much less even than remarked upon by Dr. T. Anderson in his 'Aden Florula.' There are very few genera of more than three species. *Eragrostis* has ten; *Aristida*, 9; *Panicum*, 8; *Heliotropium*, 7; and *Corchorus*, 6.

I append descriptions of those species which have not been published, or which call for remark. There are some three or four which I cannot agree in uniting as Dr. Anderson did. My reasons I have given in detail in the notes.

In fine, I beg to offer my thanks for the valuable assistance afforded to me at Kew by our President, Dr. Hooker, Professor Oliver, and Mr. Black.

# FLORULA MALLICA.

## THALAMIFLORÆ.

### RANUNCULACEÆ.

Ranunculus sceleratus, *L.* 776. Not very common.

### MENISPERMACEÆ.

Cocculus villosus, *DC. Prodr.* i. 98. Common towards the north, rarer towards the south.

—— Leæba *a*, *DC. P.* i. 99. *a.* A lofty climber: rare.

—— —— *β*. tomentosa. *β*. Prostrate on rocks at Shahkot, &c.

Anamirta Cocculus. *Cultivated.*

### NYMPHÆACEÆ.

Nymphæa Lotus *γ*. pubescens, *L.* Rare.

### NELUMBIACEÆ.

Nelumbium speciosum, *DC. P.* i. 311. *Cult.*

### PAPAVERACEÆ.

Papaver album, *L.* 726. *Cult.*

Argemone Mexicana, *L.* 727. Gradually spreading from the north downwards. It had not reached Multan in 1854.

Hypecoum procumbens, *L.* 180 (*Chiazospermum pendulum*, Bernhardi). The Punjab form has larger leaves than the European and Levant forms. The siliques are sickle-shaped and not pendulous.

Fumaria parviflora. Very abundant.

### CRUCIFERÆ.

Farsetia Edgeworthii, *H. f. & T. Linn. Journ.* v. p. 147. Chandniot Hills.

—— Jacquemontii, *H. f. & T. l. c.* p. 148. Most abundant. (Punjabi, *Farid muri.*) Pleasant biting taste: considered a specific for curing rheumatism.

—— Hamiltonii, *Royle.* Principally towards the north-east.

Cochlearia flava (*alyssoides*). River-banks, towards north and east.

Malcolmia Africana, *L.* (*Arabis arvensis*, Edgew. Linn. Trans.). Only to the north.

Sisymbrium Irio, *L.* Fields.

—— irioides, *Boissier.* Fields. Boissier describes *irioides* as larger than *Irio*, whereas this is rather smaller, and as having white petals, whilst those of this are dirty yellow.

—— —— *β*. or nitidum? A much more delicate plant. In the Rechnab Bar or desert, and on the rocks at Chandniot. I should rather refer it to *S. nitidum.*

Lepidium sativum, *L.* *Cult.*

Brassica Rapa, *L.* Extensively cultivated. The roots sliced and dried in the sun.

—— Stocksii, *H.f. & T.* I have only rarely observed this accidentally in fields: not cultivated.

—— Eruca, *L.* Much cultivated for its oil.

—— (*Sinapis*) campestris, *L.* *Cult.* "*Sarson.*"

—— juncea, *L.* *Cult.* "*Rai.*" These native names have been accidentally transposed in the paper in the Linn. Journ. v. pp. 169, 170.

Goldbachia lævigata, *DC.* Corn-fields, only towards the north-west.

Dipterygium glaucum, *Dcn. Fl. Sinaica.* Sand-hills to the south.

Raphanus sativus, *L.* *Cult.* The siliques boiled as a pot-herb—not the root.

## RESEDACEÆ.

Oligomeris glaucescens, *Dcn. Jacqt.* t. 25 (*Reseda oligandra,* J. A. S. vii. p. 764).

## CAPPARIDEÆ.

Capparis spinosa (*obovata,* Royle), *Jacqt.* t. 21. I find no description of the dehiscence of the fruit in any European Flora. It is noted by Decaisne in Jacquemont. When ripe the skin separates and curls up in three or four segments like a *Martagon,* showing the seeds immersed in crimson pulp. It is found abundantly at Multan, but not in the next region northward, and appears again in the confined valleys of the Sutluj, Beyas, &c., as far as the Indus at Iskardo. The fruit is pickled by the natives. I preserved the buds in the European style and found them first-rate.

—— decidua (*Sodada,* Forsk.) (*aphylla,* Roxb.). Most abundant: much used for firing, as it burns with a gaseous flame. The largest individual I have observed was near Chichawatni, at Jhangbiabani, 8 feet in girth.

Cratæva Roxburghii. *Gardens.*

Cadaba Indica. Rocks at Chandniot.

Cleome papillosa (*C. gracilis,* Edgew. J. A. S.).

—— brachycarpa, *DC.* (*C. Ruta,* Dcn. in Jacquemont, t. 19).

Polanisia viscosa. Fields.

Gynandropsis pentaphylla. Fields, and in the desert. Eaten as a vegetable. (*Gandhūli,* Ind.)

## POLYGALACEÆ.

Polygala (Blepharidium) erioptera, *DC.*—See note, p. 199.

## ELATINACEÆ.

Lancretia æstivosa, *W. A.* The flowers are as often twin as solitary. The carpels are very often destroyed by a small Cerambyx.

Bergia ammannioides.

### CARYOPHYLLACEÆ.

Vaccaria parviflora. Corn-fields.

Silene conoidea. Ditto.

Stellaria media. Ditto.

Stipularia flaccida, *Roxb.* This differs not only in its decandrous flowers, but in the seed, which is broadly winged. In *pentandra* the seed is scrobiculate and scarcely winged, while in *fallax* the seed is a compressed sphere without any wing.

Spergularia rubra. Fields.

Polycarpæa corymbosa. Fields.

### PORTULACACEÆ.

Portulaca meridiana. Gardens and desert.

—— quadrifida. Ditto ditto.

—— oleracea. Cultivated as a vegetable.

### MOLLUGINEÆ.

Mollugo Cerviana. Fields and desert.

—— nudicaulis. Ditto ditto.

Orygia trianthemoides. Chandniot, &c.

Glinus lotoides. Desert.

### FRANKENIACEÆ.

Frankenia pulverulenta. In sodiferous soil, but rare.

### MALVACEÆ.

Abutilon Indicum. (Ind. *Abut kanda.*) Used in coughs.

Sida cordifolia.

—— grewioides, *Guil. & Per. Fl. Seneg.* 71. This differs from the African form in the petioles being longer, and the pedicels ½ to 1 inch long, not *subsessile* as described. The carpels are rugose on the back and shortly beaked.

—— humilis.

Malva vulgaris.

—— parviflora.

Althæa Ludwigii.

Hibiscus micranthus, *Linn.* Chandniot hills.

—— laguneoides. In cotton-fields.—See description, p. 199.

Abelmoschus esculentus.

Gossypium herbaceum. *Cult.*

### TILIACEÆ.

Corchorus depressus (*Antichorus*), *L.*

—— trilocularis.

—— olitorius.

—— capsularis.

Corchorus fascicularis.
Grewia Asiatica. Gardens.
—— populifolia? Bār. (*Gangher*, Ind.)
Triumfetta rotundifolia.

### MELIACEÆ.

Melia composita. *Cult.*
Azadirachta Indica. *Cult.*

### SAPINDACEÆ.

Cardiospermum Halicacabum.

### AMPELIDEÆ.

Cissus carnosa.
Vitis vinifera. *Cult.*

### GERANIACEÆ.

Monsonia Mallica. Perhaps a var. of *Erodium niveum*, Decaisne.—See description, p. 200.

### OXALIDEÆ.

Oxalis corniculata.

### ZYGOPHYLLACEÆ.

Zygophyllum simplex. Seeds eaten in the desert. Called "*Alethi*," as well as *Trianthema.*
Tribulus alatus. Seeds eaten in the desert. Called "*Bhūkri.*"
—— lanuginosus.
Fagonia Cretica, *Linn.* (*Arabica*, *Mysorensis*, &c.). Very variable, with simple and ternate leaves.

### RUTACEÆ.

Peganum Harmala. Desert.

## CALYCIFLORÆ.

### RHAMNACEÆ.

Zizyphus nummularia. Not very plentiful.
—— Jujuba β. hortensis. The wild species does not reach this region, as far as I have observed.
—— —— γ. Hysudricus.—See note, with description, pp. 200–202.
—— Spina-Christi.
—— vulgaris. In gardens: rare.

### ANACARDIACEÆ.

Mangifera Indica. *Cult.*: peculiarly delicious in Multan.

### MORINGACEÆ.

Hyperanthera pterygosperma. *Cult.*

## LEGUMINOSÆ.

Edwardsia Hydaspica. Gardens at Multan, from the Salt range.
Crotalaria Burhia. Desert.
Lotus corniculatus. Damp sand by the rivers.
Trigonella Fœnum-græcum. *Cult.*
—— incisa.
Melilotus leucantha.
—— parviflora.
Medicago lupulina.
Cyamopsis psoraleoides. *Cult.*
Psoralea plicata. (*Bakhtmal*, Ind.) Camels delight in it.
Indigofera linifolia.
—— cordifolia.
—— enneaphylla.
—— ornithopodioides, *Schimp.* This seems to me different from *Senegalensis.*
—— tinctoria. *Cult.*
—— paucifolia. The Indian form is more torulose than the African.
Macronyx stricta, *Dalz.* (*Tephrosia tenuis*, Wall. Cat.).
Tephrosia purpurea. Rare, though so abundant in the Cis-Sutluj.
Clitoria Ternatea. *Cult.*
Sesbania Ægyptiaca. *Cult.*
—— aculeata. Fields.
Astragalus contortuplicatus.
—— tribuloides.
—— prolixus.
Alhagi Maurorum.
Æschynomene Indica.
Cicer arietinum. *Cult.*
Ervum Lens. *Cult.*
—— hirsutum. Fields.
Vicia sativa (*angustifolia*, DC.). Fields.
Pisum sativum. *Cult.*
Lathyrus sativus. *Cult.*
—— Aphaca.
—— sphæricus, *Retz.* (*angulata*). Fields.
Abrus precatorius. Jungle.
Rhynchosia medicaginea. Jungle.
—— sericea. Jungle.
Phaseolus Mungo (*Roxburghii*, W. & P.). *Cult.*
—— aconitifolius. *Cult.*
Dolichos Lablab. *Cult.*
Canavalia gladiata. *Cult.*
Dalbergia Sisoo. Wild and *cult.*
Butea frondosa. Rare, and only towards the north.
Erythrina Indica. *Cult.*
Prosopis spicigera. Most abundant.

Acacia Farnesiana. *Cult.*
—— Jacquemontii.
—— Arabica. Both the common and the cupressiform: sometimes both varieties on the same tree. It grows to a much larger size than in the N.W.P. I have measured one 16 feet 4 inches in girth, and several 11 or 12 feet.
—— modesta. Only towards the north.
Albizzia Lebec. *Cult.*: never, apparently, wild.
Cathartocarpus Fistula. *Cult.*
Cassia suffruticosa. *Cult.*
—— Tora.
—— Sophera. Rare.
Bauhinia variegata. *Cult.*
Tamarindus Indica. *Cult.*: very rare.

## ROSACEÆ.

Potentilla supina.
Rosa Indica. *Cult.*
—— Damascena. *Cult.*
Neuroda procumbens. Sand-hills.
Amygdalus Persica. *Cult.*
—— vulgaris. *Cult.*
Pyrus Malus. *Cult.*
Cydonia. *Cult.*

## GRANATEÆ.

Punica Granatum. *Cult.*

## SALICARIEÆ.

Lawsonia alba. *Cult.* both in gardens and at a few places (*e.g.* Mailsian) in fields for the dye.
Ammannia vesicatoria.
—— multiflora.
Ameletia rotundifolia.
Rotala Roxburghii.

## TAMARISCINEÆ.

Tamarix dioica. Called "*Lai.*"
—— Gallica. Called "*Pilchi.*" Occasionally producing manna.
—— orientalis (*Faras*, Royle). Called "*Pharma.*" Generally covered with salt, so much that poor people dip it in water to season their bread. The wood when burnt is most offensive and stercoraceous. It grows with great rapidity. I have measured trees of six or seven years' growth 5 feet in girth, and they fall down of old age at twenty years.

## CUCURBITACEÆ.

Cucumis trigonus. Desert.
—— pubescens. Wild.
—— —— Melo. Many varieties of the Musk Melon, of great excellence.

Cucumis usitatissimus. "*Kakri.*"
—— cicatrisatus, *Stocks.* "*Albinda.*"
—— Momordica. "*Pūnt.*"
Citrullus vulgaris. *Cult.*
—— fistulosus (*St.*). *Cult.* H. J. B. iii. p. 74.—See description, p. 202.
—— Colocynthus.
Luffa pentandra. *Cult.*
—— acutangula. *Cult.*
Lagenaria vulgaris. *Cult.*
Momordica Charantia. *Cult.*, and wild in sand-hills.
Mukia scabrella.

I have not observed any species of *Trichosanthes* or *Coccinia*, which are common in Sirhind and Lahore.

### AIZOONEÆ.

Trianthema pentandra, *Linn.* "*Itsit.*"—See description, p. 202.
—— crystallina, *Forsk.* "*Alethi.*" The seeds are swept up on the bare hard soil on which it grows and eaten in times of scarcity. It covers miles of the desert, particularly in the Rechnab Bār.—See description, p. 203.
—— Hydaspica.—See description, p. 203.

### UMBELLIFERÆ.

Anethum Sowa.
Petroselinum sativum.
Ptychotis Ajwain.
Coriandrum sativum. Wild, among pulse fields.

### RUBIACEÆ.

Hedyotis Burmanniana.
Wendlandia cinerea. Two stray specimens carried down by the Jhilum and Chenab, and growing wild.

### COMPOSITÆ.

Vernonia cinerea.
Berthelotia lanceolata.
Grangea Ægyptiaca.
Blumea, sp. ——.
Eclipta prostrata.
Francœuria crispa.
Xanthium Strumarium.
Myriogyne minuta.
Trichogyne cauliflora.
Echinops echinatus.
Microlonchus divaricatus.
Cirsium arvense.
Carthamus Oxyacanthus. Not so common as in Sirhind.
—— tinctorius. *Cult.*

Microrhynchus sarmentosus.

—— nudicaulis.

Sonchus oleràceus. Rare (sand-hills).

—— Candollianus (*Zollikoferia*, DC.). The pappus is remarkable, and very different from that of the normal *Sonchi*.

Cichorium Intybus. *Cult.*

Lactuca sativa. *Cult.* for the seeds, which are used as a medicine.

## COROLLIFLORÆ.

### PRIMULACEÆ.

Anagallis cærulea.

### SAPOTACEÆ.

Mimusops Elengi. *Cult.* A tree in the Huzūri Bagh, Multan; said to have been brought by the late Nawab of Multan from Mecca.

—— Kauki. *Cult.*

### APOCYNEÆ.

Nerium odorum. *Cult.*

### ASCLEPIADACEÆ.

Leptadenia Jacquemontii.—See note, p. 204.

Dæmia extensa.

Calotropis procera (*Hamiltonii*). In Bari Bār grows quite arboreous, 1½ feet in girth.

Pentatropis spiralis. The Punjab and Sindh plant is this species—not *microphylla*.—See note, p. 204.

Periploca aphylla.

Oxystelma esculentum.

Ceropegia esculenta. Both the tubers and leaves eaten as a vegetable. (*Gahlōt*, Ind.)—See description, p. 204.

Boucerosia edulis. Eaten as a vegetable. (*Situn*, Ind.)—See description, p. 205.

### GENTIANACEÆ.

Limnanthemum Kleinianum.

Slevogtia orientalis.

### BIGNONIACEÆ.

Tecoma undulata (*Jacq.*). Rare, but found both in Rechnab and Bari deserts. (*Lahúra*, Ind.)

### CONVOLVULACEÆ.

Cressa Cretica.

Convolvulus arvensis. Fields: remarkably large and sweet-scented.

—— pluricaulis. Desert.

Batatas pentaphylla. Rechnab Bār.

Ipomæa Pes-Tigridis.

—— sessiliflora. With a variety.

—— reptans. Not common.

Pharbitis Nil.

Rivea hypocrateriformis.

Cuscuta reflexa.
—— planiflora. Found in a field of Cashmir lucerne at Gogaira.

### CORDIACEÆ.

Cordia Myxa. *Cult.*
—— subopposita. *Cult.*

### BORAGINEÆ.

Ehretia serrata. In the Bār.
Heliotropium supinum.
—— Europæum.
—— bicolor.—See note, p. 205.
—— ramosissimum.
—— marifolium.
—— strigosum.
—— brevifolium.
Tournefortia subulata (*Edgeworthii,* DC.).
Arnebia hispidissima.
Nonnea Edgeworthii.
Trichodesma Africanum.
—— Indicum.
Anchusa hispida.

### SOLANACEÆ.

Lycium Europæum (*Edgeworthii,* DC.).
Withania somnifera.
—— coagulans (*Puneeria,* Stocks). (Ind. *Akri*: the fruit *Panni* or *Panir.*)
Solanum xanthocarpum.
—— gracilipes. Rechnab Bār.
—— nigrum.
—— Melongena. *Cult.*
Datura fastuosa. *Cult.*
Capsicum ——. *Cult.*

### SPHENOCLEACEÆ.

Pongatium Zeylanicum.

### SCROPHULARINEÆ.

Doratanthera linearis. Desert.
Antirrhinum Orontium. Fields.
Linaria ramosissima. Chandniot.
Celsia Coromandeliana. Edges of rivers.
Herpestes Monieri. Ditto.
Mazus rugosus. Ditto.
Lindenbergia urticifolia.
—— macrostachya. Chandniot.
Veronica Buxbaumii. Fields and gardens.
—— Anagallis. Edges of rivers.
Striga euphrasioides.

### OROBANCHEÆ.

Phelipæa Calotropidis. On the roots of *Calotropis* only. Differs from *lutea* in the anthers, which are mucronate, while in this they are obtuse.

### LABIATÆ.

Ocymum Basilicum. *Cult.*
—— sanctum. *Cult.*
Mentha incana? *Cult.*
Salvia pumila. Edges of rivers.
—— plebeia. Ditto.
Leucas urticifolia. Rechnab Bār.
Dracophyllum Royleanum. *Cult.*

### VERBENACEÆ.

Verbena officinalis.
Lippia nodiflora.
Clerodendron phlomioides.
Vitex bicolor.

### ACANTHACEÆ.

Dipteracanthus patulus. Chandniot and Shahkot rocks.
Barleria ciliata. Ditto.
Acanthodium spicatum. Desert.
Peristrophe bicalyculata. Only once found.

### PLUMBAGINEÆ.

Plumbago Zeylanica.

### SALVADORACEÆ.

Salvadora oleoides. Most abundant: the fruit much eaten in the desert. 12 feet in girth at Thannam; at Baluana 11 feet 4 inches. (Ind. *Van*: the fruit is *Pīlū.*)

—— Indica. Rare: leaves eaten as a salad. At Pakpatan 14 feet 9 inches in girth.

### PLANTAGINEÆ.

Plantago amplexicaulis.
—— Ispagula. *Cult.*

## MONOCHLAMYDEÆ.

### PHYTOLACCACEÆ.

Limeum Indicum, *Stocks, in Anderson, Fl. Adenensis, Linn. Journ.* v.—See description, p. 206.

Giesekia pharnaceoides.
—— rubella.

### SALSOLACEÆ.

Beta vulgaris. *Cult.*
Chenopodium murale.
Spinacia oleracea. *Cult.* Not introduced by Europeans, but by the Arabs.
Kochia arenaria. Very abundant.
Sueda Indica (*Salsola lana*, Edgew.). (*Lani*, Ind.)

Anabasis multiflora. (*Lana*, Ind.) Grows in the Bari Bār to 7 or 8 feet high, like a dwarf tree.

Caroxylon fœtidum. (*Gora lana*, Ind.)

Salsola Griffithsii. (*Khar*, Ind.) Used for preparing *Sajji*, potash.

### AMARANTHACEÆ.

Celosia argentea.

Amaranthus Mangostanus. *Cult.*

—— Gangeticus. *Cult.*

—— angustifolius.

—— Blitum.

Mengea tenuifolia.

Euxolus caudatus.

Achyranthes aspera.

Digera arvensis.

Alternanthera denticulata.

Pupalia lappacea.

Ærua Javanica.

—— Bovii.—See description, p. 206.

—— brachiata.

—— scandens.

### NYCTAGINEÆ.

Boerhaavia elegans. (*Helra*, Ind.) Much eaten in the desert. The seeds mucilaginous.

—— diffusa.

—— repens.

—— vulvariifolia.

### POLYGONACEÆ.

Polygonum glabrum.

—— Dryandri.

Rumex dentatus (*Wallichianus*).

Calligonum polygonioides.

### EUPHORBIACEÆ.

Phyllanthus Niruri.

Emblica officinalis. *Cult.*

Crozophora oblongifolia.

—— plicata.

Euphorbia Helioscopia.

—— Chamæsyce.

—— granulata, *Forsk.*

Ricinus communis. *Cult.*

### URTICACEÆ.

Cannabis sativa. *Forskälea* probably exists in the rocks at Chandniot, but I did not see it.

Ficus Indica.

—— religiosa.

—— caricoides.

Morus Indica.
—— Tatarica. *Cult.*

### SALICINEÆ.

Populus Euphratica.
Salix Babylonica. *Cult.*
—— tetrasperma. *Cult.*

### GNETACEÆ.

Ephedra alata.

## ENDOGENES.

### ORCHIDEÆ.

Zeuxine sulcata.

### PALMÆ.

Phœnix dactylifera. Introduced by the Arabs in the seventh century; now forming vast self-sown groves.

### ASPHODELEÆ.

Asphodelus fistulosus.
Asparagus, sp. Rechnab and Chaj Bārs.
Allium Cepa. *Cult.*
Uropetalum probably exists, though I never met with it.

### AMARYLLIDEÆ.

Narcissus poeticus. Gardens.
Crinum, sp. Gardens.

### TYPHACEÆ.

Typha latifolia.

### CYPERACEÆ.

Cyperus rotundus, *Linn.*
—— procerulus.
—— Irio.
—— pygmæus. *Stylo trifido,* as also in the Egyptian and Australian forms.
Scirpus grossus.
—— affinis (*Nees*).
Fimbristylis communis, *Knth.*
Eleocharis palustris.

## GRAMINACEÆ.

### ORYZEÆ.

Oryza sativa. *Cult.*

### OLYREÆ.

Zea Mays. *Cult.*

### PANICEÆ.

Paspalum scrobiculatum. *Cult.*, but not common.
Panicum brizoides.
—— colonum.
—— coccospermum (*vestitum,* Nees).
—— psilopodium.

Panicum antidotale.
—— miliare. *Cult.*
—— Hydaspicum. Desert.—See description, p. 207.
—— miliaceum. *Much cultivated.*
Digitaria ciliaris.
—— sanguinolenta.
Oplismenus prostratus (*Pan. setigerum*, Roxb.).
—— Crus-Galli (*Pan. hispidulum*, Roxb.).
Setaria Italica. *Cult.*
—— glauca.
—— verticillata.
Pennisetum Cenchri.
Cenchrus echinatus.
—— montanus, *Nees*. Varies with green or purple spikes.
Penicillaria spicata. *Cult.*
Lappago racemosa.

### PHALARIDEÆ.

Phalaris minor.

### ANDROPOGONEÆ.

Imperata cylindrica (*Kœnigii*).
Erianthus Ravennæ.
Saccharum Sara.
—— canaliculatum.
—— spontaneum.
—— officinarum. *Cult.*
Andropogon Bladhii.
—— annulatus.
—— pertusus.
—— (Cymbopogon) Arriani.—See description, p. 208.
Vetiveria muricata. Abundant in the north, but ceases about 80 miles north of Multan.
Sorghum vulgare. *Cult.*
—— Halepense. Rare.
Apluda communis, *Nees* (*aristata*, Roxb.).
Elionurus hirsutus.

### STIPACEÆ.

Aristida (Chætaria) *a*. vulgaris.
—— —— *β*. var. cærulescens.
—— hystricula, n. sp.—See description, p. 208.
—— (Arthratherum) Royleana.
—— funiculata.
—— Mallica, n. sp.—See description, p. 209.
—— articulata, n. sp.—See description, p. 209.
—— (Stipagrostis) plumosa, *Linn.* nec *T. Anderson.*—See description, p. 209.
—— pogonoptilum, *Jaub. & Spach*, no. 129?; no. 638 of *Stocks's Herb.*
—— hirtigluma.

### AGROSTIDEÆ.

Polypogon Monspeliensis.
Vilfa scabrifolia, *Hochst.* no. 2302; no. 667 of *Stocks.*
—— commutata.
—— pallida.

### PAPPOPHOREÆ.

Pappophorum Arabicum?
—— nanum (*Vincentianum,* Schmidt).
—— Persicum? An *Aucheri?* but much taller.

### CHLORIDEÆ.

Eleusine Corocana. *Cult.*
—— flagellifera (*Arabica*).
Dactyloctenium Ægyptiacum.
—— var.? mucronatum. No. 54689, *Aucher.*
Cynodon linearis.
Dinebra verticillata.
Chloris villosa. Shahkot.
Schœnfieldia pallida. Rare.

### ARUNDINEÆ.

Arundo Donax.
Phragmites Roxburghii.

### HORDEEÆ.

Hordeum 6-stachyum. *Cult.*
Triticum æstivum. *Cult.*
—— hybernum. *Cult.*
—— durum. *Cult.*
Lolium temulentum.

### AVENEÆ.

Avena fatua.

### POEÆ.

Æluropus repens (*Nilotica*).
Poa annua.
Eragrostis poæoides.
—— unioloides.
—— Brownii.
—— tremula.
—— plumosa.
—— interrupta, *Roxb.*
—— viscosa, *Roxb.*
—— nutans.
—— diandra, *Roxb.*
—— cynosuroides. "*Panni.*"

### BAMBUSEÆ.

Bambusa. *Cultivated* at Baghdad, 40 miles above Multan.

### MARSILEACEÆ.

Marsilea quadrifolia.

### EQUISETACEÆ.

Equisetum.

### FILICES.

Adiantum Capillus-Veneris. In old wells.

### MUSCI.

Phascum, sp.

| | Cult. | Spont. | Cis Sutlej. | Sindh. | India. | Arabia & Africa. | Europe. |
|---|---|---|---|---|---|---|---|
| THALAMIFLORÆ. | | | | | | | |
| Ranunculaceæ | .. | 1 | 1 | 1 | 1 | 1 | 1 |
| Menispermaceæ | 1 | 2 | 1 | 2 | 1 | 1 | .. |
| Nymphæaceæ | .. | 1 | 1 | 1 | 1 | 1 | .. |
| Nelumbiaceæ | 1 | .. | .. | .. | .. | .. | .. |
| Papaveraceæ | 1 | 3 | 2 | 3 | 1 | 2 | 2 |
| Cruciferæ | 6 | 11 | 4 | 9 | 4 | 9 | 3 |
| Resedaceæ | .. | 1 | 1 | 1 | 1 | 1 | .. |
| Capparideæ | 1 | 7 | 4 | 7 | 5 | 7 | 1 |
| Polygalaceæ | .. | 1 | .. | 1 | .. | 1 | .. |
| Elatinaceæ | .. | 2 | 1 | 2 | 2 | 1 | .. |
| Caryophyllaceæ | .. | 6 | 5 | 6 | 6 | 5 | 5 |
| Portulacaceæ | .. | 3 | 3 | 3 | 2 | 2 | 1 |
| Mollugineæ | .. | 4 | 3 | 4 | 4 | 4 | 1 |
| Frankeniaceæ | .. | 1 | .. | 1 | .. | 1 | 1 |
| Tamariscineæ | .. | 3 | 2 | 3 | 1 | 2 | 1 |
| Malvaceæ | 2 | 9 | 6 | 9 | 8 | 8 | 3 |
| Tiliaceæ | 1 | 7 | 5 | 7 | 7 | 7 | .. |
| Meliaceæ | 2 | .. | .. | .. | .. | .. | .. |
| Sapindaceæ | .. | 1 | 1 | 1 | 1 | .. | .. |
| Geraniaceæ | .. | 1 | .. | .. | .. | 1 | .. |
| Oxalideæ | .. | 1 | 1 | 1 | 1 | 1 | 1 |
| Zygophyllaceæ | .. | 4 | 2 | 4 | 3 | 4 | 2 |
| Rutaceæ | .. | 1 | 1 | 1 | .. | 1 | 1 |
| Ampelideæ | 1 | 1 | 1 | 1 | 1 | 1 | .. |
| Total.. | 16 | 71 | 45 | 68 | 50 | 61 | 23 |
| CALYCIFLORÆ. | | | | | | | |
| Rhamnaceæ | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| Anacardiaceæ | 1 | .. | .. | .. | .. | .. | .. |
| Moringaceæ | 1 | .. | .. | .. | .. | .. | .. |
| Leguminosæ | 23 | 34 | 28 | 32 | 25 | 23 | 10 |
| Rosaceæ | 7 | 2 | 1 | 2 | 1 | 2 | 1 |
| Granateæ | 1 | .. | .. | .. | .. | .. | .. |
| Salicarieæ | 1 | 4 | 4 | 4 | 4 | 1 | .. |
| Cucurbitaceæ | 14 | 5 | 4 | 5 | 4 | 3 | .. |
| Aizooneæ | .. | 3 | 2 | 3 | 2 | 2 | 1 |
| Umbelliferæ | 2 | .. | .. | .. | .. | .. | .. |
| Rubiaceæ | .. | 2 | 2 | .. | 2 | .. | .. |
| Synanthereæ | 3 | 17 | 17 | 15 | 11 | 15 | 5 |
| Total.. | 55 | 69 | 60 | 63 | 51 | 47 | 18 |

| | Cult. | Spont. | Cis Sutlej. | Sindh. | India. | Arabia & Africa. | Europe. |
|---|---|---|---|---|---|---|---|
| COROLLIFLORÆ. | | | | | | | |
| Primulaceæ | .. | 1 | .. | 1 | 1 | .. | 1 |
| Sapotaceæ | 2 | .. | .. | .. | .. | .. | .. |
| Apocyneæ | 1 | .. | .. | .. | .. | .. | .. |
| Asclepiadaceæ | .. | 8 | 4 | 8 | 4 | 4 | .. |
| Gentianaceæ | .. | 2 | 2 | 1 | 2 | 1 | .. |
| Bignoniaceæ | .. | 1 | 1 | .. | 1 | .. | .. |
| Convolvulaceæ | .. | 11 | 9 | 11 | 9 | 5 | 2 |
| Cordiaceæ | 2 | .. | .. | .. | .. | .. | .. |
| Boragineæ | .. | 12 | 10 | 12 | 7 | 7 | 3 |
| Solanaceæ | 3 | 6 | 4 | 6 | 5 | 3 | 3 |
| Sphenocleaceæ | .. | 1 | 1 | 1 | 1 | 1 | .. |
| Scrophularineæ | .. | 11 | 10 | 11 | 10 | 4 | 3 |
| Orobancheæ | .. | 1 | 1 | 1 | .. | .. | .. |
| Labiatæ | 4 | 3 | 2 | 3 | 3 | 2 | .. |
| Verbenaceæ | .. | 4 | 4 | 4 | 3 | 2 | .. |
| Acanthaceæ | .. | 4 | 3 | 4 | 3 | 3 | .. |
| Plumbagineæ | .. | 1 | 1 | 1 | 1 | 1 | .. |
| Salvadoraceæ | .. | 2 | 2 | 2 | 1 | .. | .. |
| Plantagineæ | 1 | 1 | 1 | 1 | .. | 1 | 1 |
| Total.. | 13 | 69 | 55 | 67 | 51 | 34 | 13 |
| MONOCHLAMYDEÆ. | | | | | | | |
| Phytolaccaceæ | .. | 3 | 2 | 3 | 2 | 3 | .. |
| Salsolaceæ | 2 | 6 | 4 | 6 | 2 | 4 | 2 |
| Amaranthaceæ | 2 | 13 | 10 | 13 | 13 | 11 | 2 |
| Nyctagineæ | .. | 4 | 2 | 4 | 3 | 4 | .. |
| Polygonaceæ | .. | 4 | 3 | 4 | 3 | 4 | 2 |
| Euphorbiaceæ | 2 | 6 | 4 | 6 | 4 | 6 | 2 |
| Urticaceæ | 1 | 5 | 5 | 5 | 5 | 2 | 1 |
| Salicineæ | 2 | 1 | .. | 1 | .. | 1 | .. |
| Gnetaceæ | .. | 1 | 1 | 1 | 1 | 1 | .. |
| Total.. | 9 | 43 | 31 | 43 | 33 | 36 | 9 |
| ENDOGENES. | | | | | | | |
| Commelinaceæ | .. | 1 | 1 | 1 | 1 | .. | .. |
| Orchideæ | .. | 1 | 1 | 1 | 1 | .. | .. |
| Palmæ | 1 | .. | .. | .. | .. | .. | .. |
| Asphodeleæ | 1 | 2 | 2 | 2 | 1 | 1 | 1 |
| Amaryllideæ | 2 | .. | .. | .. | .. | .. | .. |
| Typhaceæ | .. | 1 | 1 | 1 | 1 | 1 | 1 |
| Cyperaceæ | .. | 8 | 7 | 8 | 8 | 5 | 2 |
| Graminaceæ:— | | | | | | | |
| Olyreæ | 1 | .. | .. | .. | .. | .. | .. |
| Paniceæ | 6 | 16 | 14 | 15 | 14 | 10 | 5 |
| Phalarideæ | .. | 1 | 1 | 1 | 1 | 1 | 1 |
| Andropogoneæ | 2 | 13 | 11 | 13 | 11 | 7 | 2 |
| Stipaceæ | .. | 9 | 7 | 5 | 3 | 5 | .. |
| Agrostideæ | .. | 4 | 3 | 4 | 3 | 2 | 1 |
| Pappophoreæ | .. | 3 | .. | 1 | .. | 3 | .. |
| Chlorideæ | 1 | 7 | 5 | 6 | 5 | 5 | 2 |
| Arundineæ | .. | 2 | 2 | 2 | 2 | 1 | 1 |
| Hordeeæ | 4 | 1 | 1 | 1 | .. | 1 | .. |
| Aveneæ | .. | 1 | 1 | 1 | 1 | 1 | 1 |
| Poeæ | .. | 12 | 10 | 12 | 8 | 6 | 3 |
| Bambuseæ | 1 | .. | .. | .. | .. | .. | .. |
| Oryzeæ | 1 | .. | .. | .. | .. | .. | .. |
| Total.. | 20 | 82 | 67 | 74 | 60 | 49 | 20 |

| | Orders. | Genera. | Cult. | Spont. | Cis-Sutluj. | Sindh. | India. | Arabia & Africa. | Europe. |
|---|---|---|---|---|---|---|---|---|---|
| Thalamifloræ .......... | 22 | 50 | 16 | 71 | 45 | 68 | 50 | 61 | 23 |
| Calycifloræ ............ | 8 | 52 | 55 | 69 | 60 | 63 | 51 | 47 | 18 |
| Corollifloræ............ | 16 | 52 | 13 | 69 | 55 | 67 | 51 | 34 | 13 |
| Monochlamydeæ........ | 9 | 27 | 9 | 43 | 31 | 43 | 33 | 36 | 9 |
| Exogens .......... | 55 | 181 | 93 | 252 | 191 | 241 | 185 | 178 | 63 |
| Endogens ........ | 8 | 41 | 20 | 82 | 67 | 74 | 60 | 49 | 20 |
| Phanerogams ........ | 63 | 222 | 113 | 334 | 258 | 315 | 245 | 227 | 83 |
| Acrogens, exclusive of Fungi .......... | 4 | 4 | .. | 4 | 4 | 4 | 4 | 4 | 4 |
| Grand total.. | 67 | 226 | 113 | 338 | 262 | 319 | 249 | 231 | 87 |

## *Notes on some of the Plants in the foregoing list.*

### POLYGALA.

There seems to be very much confusion about these *Blepharidia*. Dr. T. Anderson, in his 'Florula Adenensis,' unites a vast number of the forms published in DC. Prod. and Wight and Arnott, Prod., under the name *triflora* of Linnæus. I have examined the original specimens in the Herrmann herbarium in the British Museum, no. 269, published by Linnæus in the 'Flora Zeylanica,' vol. ii. p. 10; I have carefully compared them with the numerous specimens in the Kew herbarium, and have satisfied myself that there are three or four distinct species. *Triflora* is *rosmarinifolia* exactly. The *triflora* of Wight and Arnett has not such pointed leaves and alæ; the capsules are not at all margined, and usually pubescent, not glabrous. Both of these forms, as well as the third, *serpyllifolia,* to which I would refer the Aden species, though it differs somewhat from the Indian form, are prostrate. The last form is that described by DC. under the name *erioptera,* which does not suit this particular form, as the alæ are almost glabrous—only delicately ciliolate; it may probably be the "*obtusata*" of DC. The pubescent form obtains principally to the West of Africa, while those from Egypt and Abyssinia are almost identical with the Multan type.

**HIBISCUS LAGUNEOIDES.** Bipedalis, ramosus, omnino pilis stellatis pubescens, foliis late ovatis plus minus trilobatis repandis, stipulis minutis subulatis, floribus axillaribus solitariis, pedicellis (ramulisque junioribus) glanduloso-pilosis; involucello 9-fido; calyce 5-fido nervoso nec inflato, hirtello, pubescentia biformi; corolla parvula, petalis oblique truncatis calyce vix longioribus albis demum rubentibus; staminibus monadelphis biseriatis; antheris innumeris; stigmatibus 5; capsula ovata pubescente, pilis stellatis setisque brevibus rigidis, 5-loculari, loculis 12-spermis, seminibus nigris glabriusculis.

Both in the tamarisk jungle and in cotton-fields.

**Monsonia Mallica.** Foliis cordatis sericeis obtusis, scapis hirsutis, bracteis barbatis, sepalis mucronatis.

Multan; Sindh.

Annua, radice fibrosa, caule subnullo, foliis paulatim approximatis cordatis obtusis utrinque sericeis, nec niveis nec hirsutis nec nervosis, stipulis cuneatis ciliatis; scapis prælongis vix erectis, pilis longis patentibus albis hirsutis; umbellis multifloris, bracteis subulatis apice pilis longis barbatis, pedicellis elongatis pubescentibus; sepalis obovatis sericeo-pubescentibus marginatis longe mucronatis; petalis istis æqualibus integris; staminibus 15 in phalangibus 5 monadelphis; stylis sericeis; achenio basi acuto apice truncato rugoso pubescente, rostro prælongo plumoso, 2½–3 poll. longo.

This differs from *M. nivea* in the pubescence and texture of the leaves and the mucro of the sepals, and from *M. hispida* in the size and pubescence. Cf. Boissier, i. 8. p. 122.

I have very great hesitation about the species of *Zizyphus* cultivated in India or found in the Punjab.

The *Z. vulgaris* is cultivated in Cashmir, and, rarely, in gardens in the Punjab: I have not observed it in Multan. *Z. Jujuba* is abundant wild in the northern part of the Punjab, but not in Multan, where *nummularia* is only found sparingly, compared to the profusion seen in the northern districts. Although in the usual form no one could hesitate about the species, I have seen small stunted specimens of *Jujuba* that it would be difficult to distinguish from *nummularia* with thorns shorter than usual.

*Z. Spina-Christi* is found in gardens, but sparingly, and with some difference from the typical and Syrian form. The bark, though paler than the common Punjab *Ber*, is not the clear grey so remarkable in all the Syrian and African specimens and descriptions; and the inflorescence is almost glabrous and with almost sessile cymes, not downy and dichotomous. The petals in all that I have examined are emarginate, whereas they are entire in *Jujuba*. The name *Nabeca* was given by Forskahl to this species, after the Arabic name *Nabc*; but, unfortunately, the name *Napeca* was applied by Linnæus to some specimens collected in Ceylon by Herrmann, now in the British Museum. I have compared the original specimens with those under the same name in the Linnean herbarium, and I find them to be a form much resembling *Œnoplia*, but differing in having more glabrous leaves, longer peduncles to the cymes, and double thorns. I see specimens in the Kew herbarium almost exactly similar, from the Concan and Ceylon, from Mr. J. Walker; and it will be interesting if botanists on the spot, in Ceylon and the Concan, will ascertain if it be a different species or only a variety.

There now remains to me to define the form most abundant in the Punjab. I am not sure that it is anywhere truly wild, though I have observed it in the desert, but probably dropped by man or bird.

This species is immediately noticed on entering the western part of the Cis-Sutluj States, where it first appears as a small tree (the branches not drooping as the typical wild or cultivated *Jujuba*), and with almost smooth leaves. There is a slight pubescence in young specimens, but they are almost glabrous when old. The fruit is globular and dark-coloured, not orange or red like the wild Ber, or green like the cultivated. The leaves are usually roundish ovate, more or less serrulate. The inflorescence varies from perfect smoothness to thick tomentum. The cymes are usually short, sometimes reduced to a fascicle of flowers as in *Lotus*.

At first I had referred this to *Lotus*, but on comparison I find it is quite distinct; and there are no specimens in the herbaria leading from one form to the other; while it is difficult to consider this form to be only a variety of *Jujuba* as it has hitherto been defined.

Wight and Arnott define it by the tawny colour of the under surface of the leaf; but in the cultivated specimens, as well as in other northern wild specimens, the pubescence is almost grey, while we see a similar difference in the colour of the tomentum in *Œnoplia* and *nummularia*. Therefore I believe it is more correct to consider it a well-marked variety of *Z. Jujuba*.

ZIZYPHUS JUJUBA. Arbor, foliis ovatis serrulatis v. integris, spinis geminis, una longiore rectiuscula, altera uncinata, cymis brevibus, petalis unguiculatis concavis integris demum reflexis.

*a. spontaneus.* Foliis subtus ferrugineo-tomentosis, drupis sphæricis flavo-aurantiacis.

*β. hortensis.* Foliis late ovalibus 3-nerviis basi inæqualibus *integerrimis* nervis apice breviter mucronatis, sursum glabris, subtus cano-tomentosis, cymis subsessilibus; pedicellis pedunculo longioribus vix petiolum æquantibus, multifloris, alabastris depressis tomentosis sublanatis; drupis ovatis viridibus vel flavescentibus.

Hortis passim.

γ. *Hysudricus.* Foliis ovalibus obtusissimis basi paulo inæqualibus, junioribus pubescentibus demum utrinque glabratis serrulatis, cymis petiolo sublongioribus, pedicellis vel *glabris* vel lanatis integris; drupa globosa viridi-purpurascente.

Punjab, passim.

CITRULLUS FISTULOSUS, *Stocks in H. J. B.*, vol. iii. p. 74. Hirsutus, foliis cordatis sinuato-lobatis v. pinnatifidis, flore hirsuto, stam. non nectariferis, pepone globoso hirsuto.

Sindh; Multan.

Hirsutissimus, caulis demum fistulosus. Folia cordata, sinuato-lobata pinnatifidaque laciniis obtusis rotundatis; juniora molliter, seniora scabre hirsuta, glandulosa, moschata, pallide virescentia. Cirrhi 2–4-fidi; bracteæ cucullatæ, glabriusculæ, 1–3-floræ. Flores pedunculati; ♂ pedunculis fœmineis triplo longioribus. Calyx complanatus, tubo subnullo, breviter 5-dentatus, dentibus subulatis. Corolla subrotata v. cyathiformis, extus hirsutissima, intus pallide flava glabra venosa 5–7-partita. Stamina 5, basi quasi articulata, nec fornicata nec ciliata, 2–3–4-adelpha, connectivo 3–4-lobato. Anthera sinuata; discus centralis depressus, subtrigonus. ♀ Calycis tubus contractus, brevissimus, limbo plano breviter 5-dentato. Corolla extus hirsutissime, intus glabre 5-partita (profundius quam in masculo), segmentis ovatis acutis. Stamina rudimentaria, 2–3, quorum 2 bidentata, glabra, nec basi nectarifera. Discus glandulosus, annularis, pulvinatus. Stylus brevis, crassus, 3-fidus, stigmatibus convoluto-infundibuliformibus. Ovarium 3-loculum, globosum, hirsutum. Pepo globosus, seminibus marginatis obtusis.

This species is found in Sindh and Multan, and much cultivated under the names of *Tinda*, *Albinda*, and *Dil-pasand*, "beloved to the heart": eaten cooked as a gourd. It seems a very different species from the water-melon, to which it is nearest. The stamina of the latter are nectariferous both in the male and female flower, as well as in *Colocynthis*; the anthers are only sinuate, not gyrose or conduplicate or anfractuose. M. Nandin refers this to *C. vulgaris*, but without any note as to whether he has made any experiments to prove the unity of the species.

TRIANTHEMA PENTANDRA, *Linn.* Foliis oblique ovatis v. oblongis inæqualibus; floribus axillaribus, uno sessili cæteris brevi-pedunculatis 3–7-nis pentandris; fructu duro tetraspermo circumscisso, operculo clauso bipartibili loculo mitriformi.

North-west Provinces.

Annua, diffusa vel suberecta, ramis teretibus glandulosis. Folia opposita, inæqualia, oblique ovalia vel oblonga, subtus glauca, utrinque plus minus crystallino-papillosa, petiolis canaliculatis marginatis quasi amplexicaulibus glandulosis. Flores in axilla nidulans, unus sessilis, cæteri brevi-pedunculati terni vel septeni. Bracteæ bracteolæ scariosæ, acuminatæ. Calyx quinquepartitus, segmentis dorso carinatis cuspidatis margine membranaceis intus coloratis (rubris vel rarius albis) cum junioribus quinque alternis. Ovarium biloculare, 4-ovulatum, apice mitriformi bilobo (vel emarginato), lobis emarginatis. Styli 2, divaricati, longe stigmatosi. Fructus durus, circumscissus, operculo bipartibili dispermo clauso; cupula membranacea, disperma, placenta vera centrali sed alternatim ad parietes coalita. Semina subcompressa, rugosa, albumine pauco.

Common in cultivated ground as well as in the desert: it is called *Itsit*, and is used to procure abortion by the natives. It is generally reddish or purple, but has rarely a green fruit and stalk. It is very different from *T. pentandra β*, DC. Prod. iii. 852, which is the *obcordata* of Roxburgh.

TRIANTHEMA CRYSTALLINA. Papillosa, foliis ellipticis (vel ovalibus v. spathulatis), floribus 5–6-andris monogynis, calyce pentagono nervoso, fructu dispermo operculo cupuliformi aperto.

Arabia. India, from the Peninsula to the Punjab.

Diffusa, ramosissima, crystallino-glandulosa, ramis stellatim prostratis teretibus. Folia subopposita, crassa, elliptica, ovalia v. spathulata, vel in Pentepotamia elliptica margine revoluto semiteretia, petiolis marginatis glanduloso-fimbriatis (in ramis omnibus persistentibus marcidis). Flores terni (in *W. & A.* et *DC.* congesti), axillares, bibracteolati. Calyx pentagonus, 5-fidus, segmentis late cuneatis 5–7-nerviis, marcescens, subhyalinus, apertus. Stamina 5, vel potius 6, raro 7. Stylus 1. Ovarium truncatum, supra cupuliforme. Fructus dispermus, placenta laterali, operculo aperto. Semina compressa, cochleata, rugosa, embryone albumen farinaceum paucum cingente.

This is found both in the Peninsula and Arabia with broader leaves than the Punjab form, and less crowded branches; but I cannot consider them even as varieties. It varies in having green or red branches. It is not common in cultivated places, but in the Rechnab desert there are miles of ground covered with it; it is eaten under the name of *Alethi* (as well as *Zygophyllum simplex* and *Tribulus alatus*). The women sweep up the seeds from the bare hard soil with little whisks, and they are then winnowed and sifted.

TRIANTHEMA HYDASPICA. Papillosa, prostrata, foliis crassis ovatis, floribus in dichotomia sessilibus solitariis 5–7-andris digynis, fructu polyspermo biloculo.

Pentepotamia and Sindh.

Annua? Prostrata, omnino plus minus crystallino-punctata, ramis teretibus glanduloso-puberulis coloratis dichotomis. Folia opposita, crassiuscula, ovata, obtusa, margine revoluto, petiolo membranaceo-dilatato.

Flores solitarii, sessiles in dichotomia. Calyx 5-fidus, in sinibus segmentorum dentibus 5 (ut in *Ammannia*), acute pentagonus, segmentis ovatis extus herbaceis in mucronem glandulosum (uno excepto) productis, intus plus minus petaloideis roseis, demum in fructu stellatim patentibus. Stamina 7 (*fide Stocks* 5), filamentis filiformibus, antheris roseis. Styli duo, disjuncti, incrassati, stigmatosi. Ovarium biloculare, pluri-ovulatum, placenta centrali. Fructus pyxiformis, circumscissus, operculo clauso 2-loculari; capsula bilocularis, loculis membranaceis hinc parietis membranis sejunctis ita ut capsula pseudo-4-locularis fingitur. Semina numerosa, 8–10 in utroque loculo, cochleæformia, testa nigra rugosissima, embryone albumen paucum farinaceum cingente, cotyledonibus planis.

This appears to be peculiar to the basin of the Indus. Dr. Stocks referred it, in his letters and herbarium, to the *Diplochonium* of Fenzl. It seems to be quite different from the original species of that genus, *D. uvarioide* from the Cape being polyandrous and with smooth shining seeds. The fruit, habit, and calyx agree with this; but *Trianthema obcordata* has numerous stamens and seeds, and therefore must be referred to *Diplochonium*, if this be not rejoined to *Trianthema*.

*Leptadenia Jacquemontii*, though often leafless as described by Decaisne, as often has linear leaves exactly like those of *L. Spartium*; but the form of the corona and the pubescence of the corolla are different.

*Pentatropis spiralis* differs both in flower and foliage from *P. microphylla*, the Peninsular species. (See Pl. I. fig. 9.)

The leaves of the Punjab species are from ovate to almost linear with a gradual acumination, whereas those of *microphylla* vary from oval to ovate with a short abrupt mucro. The laciniæ of the corolla are erect, scarcely ever opening, and never reflexed, as are those of the latter, while the divisions of the outer row of the corona are blunt and rounded, not rather acutely calcarate as in *microphylla*.

Compare the dissections of *spiralis* by Decaisne (Ann. Sc. Nat. ii. 9, 11) with those of *microphylla* by Wight (Icones, ii. 352).

CEROPEGIA ESCULENTA. Volubilis, foliis carnosis ovatis linearibusve, umbellis multifloris, coronæ stamineæ lobis lateralibus obtusis.

Multan; Sindh.

Radix tuberosa, volubilis, glabra. Folia glabra, carnosa, ovato-oblonga vel linearia, 2–7 poll. longa, ½ ad 2 lata. Umbellæ compositæ, multifloræ. Calyx brevissimus. Corolla vix pollice longa, basi et fauce inflata, tubo longo, laciniis brevibus apice coalitis, pallide viridi-purpurascens, intus

leviter barbatis. Corona lobis exterioribus obtusis, interioribus ligulatis multo longioribus. Folliculi divaricati, longe cylindrici, glabri.

The leaves (which are acid) and the tubers are eaten: called *Gahlot.*

This differs from *bulbosa* of Roxb. in the exterior lobes of the corona, which are blunt, and not acute as in *bulbosa*, which I have found at Banda. The flowers also are smaller, while the leaves are larger.

**Boucerosia edulis** (Pl. I. fig. 1–8). Erecta, ramis subteretibus, foliis caducis, floribus pedicellatis geminis, corolla glabra laciniis subulatis.

Multan; Sindh.

Rhizoma stolonosum, crassum, ramis radicantibus, radicibus fibrosis. Rami erecti, succulenti, subteretes, 4-sulcati. Folia opposita, cuneata v. elliptica, caduca. Pedicelli gemini, alares, graciles, subpenduli, demum erecti, bibracteati, bracteis subulatis minutis. Calyx 5-partitus, segmentis acutis pellucido-marginatis. Corolla 5-fida, utrinque glabra, venacea, basi purpureo-striata, tubo inflato hemisphærico, laciniis subulatis attenuatis reflexis. Corona 15-fida, segmentis 5 ligulatis in antheris incumbentibus, 10 intermediis brevioribus falcato-subulatis intus cavis purpurascentibus nectariferis. Pollinia gibba, apice pellucida. Folliculi erecti, teretes, lævissimi, glaberrimi, valde attenuati. Semina marginata, alata, longe comosa.

Edulis, subacida, sponte in Salvadoretis crescit, ibi colligenda in foro venditur sub nomine *Situn.*

I refer our Desert species of *Heliotropium* to *bicolor*, Hochst. & Steud. (no. 62, DC. ix. 546), and *marifolium*, Retz. (no. 66, p. 547). I cannot agree in uniting these and several other species to *strigosum*, as Dr. T. Anderson proposes in his 'Florula Adenensis'—at least I consider it premature; for though there are many points of resemblance, there are plenty of distinguishing marks. I have carefully examined all the specimens in the Kew and Linnean herbaria, and although there may be some which are too difficult to refer to the correct species without very minute and almost microscopic examination, I feel satisfied that it is safer to leave these forms as species till more thoroughly examined in living specimens.

The distinguishing marks may be taken, firstly, in the habit—*erect* (nos. 62, 63, 64, 67, 70, 72, DC.) or prostrate (65, 66, 71, &c.). The shape of the leaves—linear, linear-lanceolate, or elliptic or oval. The laciniæ of the calyx also give distinct marks: some are long, linear, and acute (62, 67, 72, 78; 7015, Wall.); others free, short, and blunt (63, 66, 70; 1389, 1392, Wight; 2092, Wall.). The nuts also give good marks: some are almost smooth (77, 78; 1389, Wight); some smooth below and strigose above (64); others (as 62, 63, 66, 72; and 1390 of Wight) thickly strigose; some are almost exactly globose, but others distinctly four-lobed. The anthers in many have hairs, converting the apex into a little pencil, while in other species they are wanting and are either simply apiculate or even blunt. The stigma in *linifolium* is smaller and *cordiform* obclavate, in all the rest parasol-shaped, with the apicula shorter or longer according to the species.

The throat of the corolla is usually closed with hairs, but in this, which I have referred to *bicolor*, it is open and bare. I have not had an opportunity of examining this point in an Arabian specimen.

Finally, we find every shade of pubescence, from the soft down of *tenuifolium* (no. 67) to the densely strigose forms of *strigosum*, *marifolium*, and *scabrum*.

LIMEUM INDICUM, *Stocks, MSS.* Prostratum, foliis suboppositis inæqualibus oblique ovatis vel rotundis mucronatis glabris, cymis brevi-pedunculatis, petalis hyalinis obcuneatis 3-dentatis, stam. 7, coccis lævibus depressis.

Sindh to Punjab.

Annua? Rami prostrati, velutini, ad nodos incrassati, ramulis alternatim brevioribus quaque axilla. Folia subopposita, oblique ovata v. rotundata, mucronata, integerrima, utrinque glabra, crassiuscula, petiolis brevibus subamplexicaulibus stipulam mentientibus. Cymæ brevissimæ, pedunculatæ, axillares vel supra-axillares, pedicellis bracteolatis, bractea scariosa acuta. Sepala 5, quincuncialia, ovata, acuta, herbacea, margine membranacco albo. Petala 5, hyalina, unguiculata, obcuneata, apice truncata, tridentata, cum sepalis alterna. Stamina 7, filamentis basi dilatatis in discum glandulosum subcoalitis persistentibus, antheris 2-lobis introrsis. Ovarium 2-lobum, stylis 2, lobis contrariis, loculis 1-ovulatis. Fructus dicoccus, depresse subsphæricus, lævis, indehiscens. Seminis testa membranacea. Embryo annularis, albumen farinaceum amplectens, cotyledonibus longis linearibus.

The habit is that of *Glinus* or *Gisekia*. It differs from the generic character as given in DC. or Endlicher in having opposite leaves and smooth cocci.

ÆRUA BOVII, *Webb.* Ramosissima, dioica, lanuginosa, foliis sessilibus linearibus mucronatis, bracteis scariosis subglabris, stylo stigmatibus breviore.

Deserto Rechnab.

Dioica, erecta, ramosissima, lanugine stellata brevi vestita. Folia alterna, linearia, basi attenuata, apice mucronata. Spicæ axillares terminales-que simplices vel ramosæ ita ut tota planta panicula vasta videtur. Flores terni, congesti, bracteis scariose argenteis obtusis subglabris. Calyx 5-partitus, laciniis extus longe lanatis, duabus exterioribus majoribus scariosis, tribus interioribus herbaceis linea viridi vel rubra notatis angustioribus.

♂ Stamina in annulum connexa, staminodiis obtusis 2-dentatis coloratis, filamentis calyce longioribus purpureis antherisque purpureis, polline luteo. Ovarium minutum, stylo nullo.

♀ Cupula staminifera 10-dentata, dentibus alternis (staminibus abortivis) acutis. Stylus ramis stigmatiferis 1½ brevior. Ovarium 1-loculum. Semen lucidum.

This species has been confused with *Javanica*, from which it differs in habit, leaves, and the minute character of the style and bracts. In *Javanica* the style is equal to the stigmatic branches, and the bracts are lanose, not glabrous. The true *Javanica* has short branches. *Javanica* has but few and rare male flowers (as remarked by Forskahl, p. 170), whereas *suaveolens* has as many male plants as female; and *Javanica* also is not sweet-scented. They both grow in the same neighbourhood, so that there is plenty of opportunity to compare them. I therefore consider *Æ. β. Bovii* is a distinct species rather than a variety as it has been considered by Webb in the Niger Flora, p. 173, and DC. Prod. xiii. p. 299.

PANICUM (Sect. xi. VIRGARIA, *Trin. ap. Steud. Gram.*) HYDASPICUM. Foliis planis sparse pilosis, gluma exteriore 3-nervia, superiore 7-nervia. Rechnab Bār.

Culmi subcompressi, geniculati, nodique glabri. Vagina laxa, glabra, os versus ciliata, ligula minute ciliato-membranacea. Folia plana, sparse pilosa, margine minutissime serrulata, utrinque 3-nervia, sæpe purpurascentia. Paniculæ laxæ, ovatæ, pedunculo compressiusculo filiformi, ramis ramulisque capillaribus undulatis scabro-setosis. Locustæ ovoideæ, solitariæ, longe pedicellatæ. Gluma exterior flosculo plus duplo brevior late ovata, acuta, *trinervia*. Gluma superior 7-nervia, breviter mucronata. Flosculi inferioris palea inferne herbacea, semi-7-nervia, breviter mucronata; palea superne hyalina, elliptica, acutiuscula, integra.

☿ Floris superioris paleæ lævissimæ, muticæ. Lodiculæ majusculæ, ovario longiores, bilobæ, carnosæ. Ovarium læve. Styli 2, divergentes. Stigma purpureum. Stamina vix exserta. Antheræ fuscæ.

This differs from the cultivated *miliare*, Lam. (no. 483 in Steud. Gram. p. 73) in the glumes. The nerves in the lower are much stronger than any in this section that I have observed, and shorter. The upper are 7-, not 9–13-nerved. From *coloratum*, Linn. (no. 478, *ib.*) it differs in the absence of the raised glands from which the hairs rise in the vagina. *Repens*, Lam., *arenarium* (no. 476. *ib.*), and *paludosum*, Roxb. (no. 465. *ib.*) have blunt glumes, and live in water.

ANDROPOGON (CYMBOPOGON) ARIANI. Cæspitosus, foliis brevibus complanatis, pedicellis pilis albis locusta longioribus, glumis inferioribus 5–9-nerviis ciliatis, superioribus 3-nerviis.

Deserta; Punjab.

Dense cæspitosus. Folia plana, brevia, glaucescentia. Vaginæ glabræ, ligula membranacea paleacea. Culmi glabri, erecti, 1–3-pedales. Paniculæ foliaceæ; pedunculi articulati, articulis breviter barbatis, vaginulis margine membranaceis, cito marcidis, subconjugatis. Spicæ cylindricæ, pedunculos æquantes. Locustæ geminæ, una sessilis (☿), altera pedicellata (♂). Glumæ utriusque bicarinatæ, ciliatæ, acutæ, subbifidæ, carinis serrulatis. Flosculi sessilis paleæ hyalinæ, ciliatæ, superior bifida aristata, arista locustam æquante. Lodiculæ grosse eroso-truncatæ, subbidentatæ. Flosculi ♂ pedicelli dense pilosi, pilis inæqualibus locustam æquantibus. Paleæ integræ, hyalinæ, serrulatæ, deciduæ. Antheræ luteæ. Stigmata aurantiaca.

There are several forms very much resembling one another, and which have been confused together in herbaria. This species differs from all in the plane, not convolute, leaves. *Circinatus*, Hochst. (Steud. Gr. no. 294, p. 387) differs from all in the indurated polished glume. *Oliverii*, Boiss. (no. 295. *ib.*; Desf., 288. *ib.*) has rough convolute leaves, longer than those of *laniger*. The pedicel and rachis have hairs equalling the floscules. The glumes are 5-nerved. *Laniger* (from Algiers) has much shorter convolute leaves, the pedicels not quite reaching to the floscules. The glumes 7–11-nerved.

There is another species, abundant in the lower Himalaya, differing in having longer, linear convolute leaves, spikes defracted, with much shorter hairs in the pedicels, and scarcely aromatic—almost the same as the Persian *Oliverii*.

ARISTIDA (CHÆTARIA) HYSTRICULA. Pusilla, glabra, gluma superiore acutata inferiorem ovulatam mucronulatam subduplo superante.

Sindh and Multan. (*Stocks*, No. 187 partim.)

Spithamæa, pallescens. Culmi graciles, glabri, striati. Vaginæ breves, ore pilis albis, longe ciliatæ. Folia glabra, convoluta, pollicaria. Paniculæ breves, paucifloræ. Gluma inferior ovata, acuta, carina serrulata in mucronem abeunte (2-linealis); superior sublævis, linearis, in mucronem hispidulum acutata (3–3½-linealis), quandoque fissa. Flosculus hispidulus, arista non articulata, stipite 8–10-lineali, setis subæqualibus 1–1½-pollicaribus hispido-scabris.

The habit is very unlike *Hystrix* (Linn. fil.; Steud. Gram. no. 99, p. 141), though the technical description is too much like.

ARISTIDA (ARTHRATHERUM) MALLICA. Foliis scabris *pilosis*, glumis subæqualibus (inferiore paullo *longiore*) acuminatissimis in *setula* hispidula terminatis.

Multan.

Nana, vix spithamæa, culmis parce pilosis. Folia scabra. Glumæ in setula hispidula terminatæ, acuminatissimæ, longior paullo brevior (5–7-linealis) carina serrulata. Gluma superior lævis, 1-nervia (4½–6-linealis). Flosculus scaberrimus; arista paullo *super* caryopsem secedens, stipite scabro-hispido 8–9-lineali, setis duabus 10–12 lin., tertia 14–15-linealibus.

This species is technically most like *Royleana*, Trin. (Steud. Gr. no. 177, p. 143), but the habit is very different; it is of a reddish colour, and very dwarf. It seems to approach nearest to *A. lieocalycina*, Trin. (Steud. Gr. no. 120, p. 146), but I have not seen an authentic specimen of that; the proportion of the glumes also is at variance.

ARISTIDA ARTICULATA. Erecta, glabra, foliis subacerosis, panicula coarctata, glumis subæqualibus, arista ad apicem stipitis articulata.

Rechnab deserto.

Culmi erecti v. geniculatim decumbentes. Vaginæ nodique glabri. Ligula pilosa. Folia sesquipollicaria, subacerosa. Panicula coarctata. Glumæ hispidulo-scabræ; inferior paullo brevior, carinâta, acuta, mucronulata; superior bifida, intra dentes setula mucronata. Flosculus striato-hispidus; arista in glumis latitans, ad apicem stipitis articulata, setis tribus subæqualibus 6–7-linealibus.

The habit is that of *rigescens* (R. S.; Steud. Gr. no. 100, p. 141); but I do not observe any other specimens of this species in the Kew herbarium, nor any in which the awn is jointed at the branching of the setæ.

ARISTIDA (STIPAGROSTIS) PLUMOSA (*Linn.*; *Steud. Gr.* no. 125, p. 141) (*lanata* of Forskahl).

This species I have found both at Jhung and in the sand-hills to the south of the Multan district. I cannot agree with Dr. T. Anderson in referring the Aden species to this. One of the original specimens in the Linnean herbarium is identical with this. The other seems to be rather the "*obtusa*" of Delile (no. 128, Steud. Gr. p. 144). Col. Munro, in his paper on the Linnean grasses, makes no remark on this second specimen, which assuredly is a different species from the true and original *plumosa*.

In his Aden Flora Dr. T. Anderson unites *A. vulgaris*, Trin. (Steud. Gr. no. 66) to *A. Adscensionis*, Linn. (no. 76); but the blunt truncate glumes appear to me to be a most distinct characteristic.

Unfortunately I have lost or mislaid all my meteorological tables. I append an abstract of the only months I have found.

| 1850. | Minimum. | | | Maximum. | | | Mean. | Direction of Wind. | Rain. |
|---|---|---|---|---|---|---|---|---|---|
| | Extreme. | | Mean. | Extreme. | | Mean. | | | |
| April. | 60° | 73° | 67°·7 | 87° | 108° | 95° | 81°·8 | 13½ days N., 6½ S. | in.<br>0·27 |
| May.. | 66 | 88 | 76·7 | 95 | 118 | 108 | 93·35 | $12\frac{6}{2}$ N., 2 S., $6\frac{6}{2}$ W.,<br>2 N.E., 2 S.E., 2 S.W. | 0 |
| June. | 76 | 89 | 83·6 | 99 | 117 | 111 | 97·66 | 6 N.–N.N.E., 24 S.–S.S.E. | 0 |
| July.. | 70 | 87 | 79·4 | 88 | 113 | 106 | 92·8 | 4½ N., 5 N.E., 5½ E.,<br>9½ S., 5 S.W., $1\frac{3}{2}$ W. | 2·26 |
| Aug.. | 64 | 83 | 78·4 | 92 | 109 | 103 | 91·1 | 12 N., 4 N.E., 3 E.,<br>2 S.E., 8 S., 9½ S.W.,<br>2 W. | 0 |
| Sept.. | 69 | 78 | 72·9 | 97 | 108 | 99·6 | 86·2 | $3\frac{2}{3}$ N., 3½ N.E., $1\frac{1\cdot5}{2}$ E.,<br>$\frac{1\cdot5}{2}$ S., $4\frac{2}{2}$ S.W., 1 W. | 0 |

## DESCRIPTION OF THE PLATE.

Fig. 1. *Boucerosia edulis.* Corolla opened out.
2. Gynostegium and staminal crown, looking down.
3. Ditto, the staminal crown opened out.
4. Ditto, profile.
5. Part of corona opened out.
6. Ditto, magnified from the outside.
7. Ditto, ditto, from the inner side.
8. Ditto, one of the inner scales separated.
9. Coronal leaf of *Pentatropis spiralis*, copied from Decaisne, Flora Sinaica.
10. Coronal leaf of Multan form.
11. Coronal leaf of *P. microphylla*, according to Wight's Icones.

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Printed by TAYLOR and FRANCIS, Red Lion Court, Fleet Street.

# JOURNAL

OF

# THE PROCEEDINGS

OF

# THE LINNEAN SOCIETY.

## BOTANY.

VOL. VII.

LONDON:
SOLD AT THE SOCIETY'S APARTMENTS, BURLINGTON HOUSE;
AND BY
LONGMAN, GREEN, LONGMAN, ROBERTS & GREEN,
AND
WILLIAMS AND NORGATE.
1864.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.

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# JOURNAL OF THE PROCEEDINGS

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# LINNEAN SOCIETY OF LONDON.

## Letter from Mr. G. MANN, Government Botanist, describing his Expedition to the Cameroon Mountains. Communicated by Sir W. J. HOOKER, F.R.S., F.L.S., &c.

[Read June 5, 1862.]

SIR,—I have the honour to transmit to you a Report upon my expedition to the Cameroon Mountains, and at the same time to advise you that the collections which I made there are shipped to England in the same steamer that brings this letter.

I left Fernando Po on the 4th December, 1861, about 2 P.M., in a boat which I had anxiously awaited for a week. As soon as we had left the harbour and sailed round Point William, we were favoured by a strong sea-breeze, and reached Cape Horatio before sunset; whence we steered towards Ambas Bay, and, shortly before night set in, saw the Cameroons rising from the sea, and losing themselves in the clouds. Soon after 8 P.M. the islands in Ambas Bay came in sight, and after passing the first (Mondori Island), the sails were taken in, and the anchor let go. On the next day we reached the anchoring-place at 8 A.M., when I immediately landed. On landing I was received by my old host, and on reaching the house of the Rev. Mr. Saker, was informed he was at the Cameroons; but I received permission to keep the goods, which I had brought for barter, in the magazine of the mission. The place was as I found it a year before.

In the latter half of the day, I was much refreshed by the constant sea-breeze, which in Fernando Po we seldom enjoy, and which renders Victoria such a pleasant and agreeable residence for Europeans. How much more beneficial it would be for invalids if a sanitarium was established on one of the many hills which surround this settlement, when Europeans, and especially the English, who live in great numbers in the vicinity, could in five or six days exchange the dangerous climate of the Gulf of Guinea for their own, without the great expense with which such an exchange is at present connected.

The forest surrounding the settlement is the same that I saw last year,—beautiful in the beginning of December, when, from the change of season, many of the trees appeared in all the beauty of their young foliage, with large masses of flowers among various shades of green. Especially conspicuous was a species of *Baphia* ?, the flower of which looked like a peony. *Lophira alata* was already in full flower: the lady natives wear in their hair and ears the light-red wings of the fruit of this plant. The shore is bordered by an *Amomum* (1034 of list), which is here very common along the coast; but I endeavoured in vain to find the white-flowered species which I noticed last year. *Monodora grandiflora* was conspicuous from its beautiful foliage; but my hope of obtaining fruits for the Museum was vain, for I had come too late, and they were already fallen. I found, however, living seeds, which I believe to be distinct from the specimen which I sent from St. Thomas's in fruit, and Prince's Island in flower. The fruits are the same.

I found the interpreter, who accompanied me last year in my excursion to one of the highest villages on the mountain, still in Victoria, and ready to accompany me on this expedition. When, however, he heard that I should be ready in one or two days to leave the coast, he made many difficulties; and the two following days were passed, with the aid of the missionaries, in tedious endeavours to organize my party of interpreters, guides, and porters.

On the 10th December, H.M.S. Bloodhound anchored near the settlement; and Consul Burton, accompanied by Commander Dolbin, landed. The former informed me that it was his desire to visit the mountains also; and we agreed that, ten days later, I should send down some of my people to Victoria, in order to fetch some more food, and at the same time to serve as guides to Consul Burton. On the night of the 12th–13th, the rainy season bade farewell to the coast; after a few days of fine weather, however, the rain poured down again, and brought to my recollection all the difficulties under which I had brought my first collection from the mountain of Fernando Po. At the same time I determined to commence my ascent on the next day, with or without the leave of the natives.

Both the chiefs of Bassumba, the first village up the mountain, having come to the market, I agreed to go with them to their homes, and thence to Mapanya. I also met with eight natives of Bassumba, who were willing to carry part of the things for four pieces of cloth (worth £4); and on the 13th I finally left the settlement, with one interpreter, six Kroomen, and eight natives.

Mr. Pinnock, of the mission, living in Victoria, accompanied me, and after a five hours' walk we reached the village of Bassumba (alt. 1492 ft.*).

The country through which we passed was of the same forest tract that surrounds Victoria; amongst the trees was principally conspicuous an *Eriodendron*, which attained an enormous circumference. Also *Anthocleista nobilis* and *Monodora grandiflora* were conspicuous from their beautiful foliage, and *Sterculia tragacantha*, without leaves, but covered with carmine-coloured fruit. *Ipomœa* and *Momordica* grew over the trees and bushes on every side where the wood was a little more open. Among the ferns was chiefly observable a beautiful *Hypolepis*.

Here and there the forest was broken by a plantation of plantains; and where the wood had been thinned, the surface was occupied by *Saccharum spontaneum*, *Panicum plicatum*, and *Amomum Danielli*, which over-ran the roads wherever sufficient air penetrated through the trees.

Crossing a small river, a small Aroid (*Anubias Barteri*, Sch.) attracted my attention by its beautiful snow-white flowers; it covered the stones in the stream, as well as the banks. *Anchomanes Hookeri* was seen on every side, yet manifestly smaller than in Fernando Po. *Elæis Guineensis* and *Raphia vinifera* are common; the latter grows to the height of 700 feet above the sea, and, as everywhere on the coast, forms the chief material in the construction of the huts.

When I wanted to leave Bassumba, on the morning of the 14th, to go to Mapanya, all the natives declared they were tired, and that they could not go until the following day; so that I was compelled to wait. I made an excursion during the day, and found, amongst other things, the large Aroid bulb which I send alive.

I gave the interpreter leave to go back to the settlement to see his sick mother, on condition that he came back in the evening;

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* This and the following altitudes are approximate only, calculated from boiling-point observations.

but he did not do this, and I should have been in great difficulty if Mr. Pinnock had not had a youth with him who was acquainted with the language, and whom he kindly allowed to remain with me.

After another altercation with the natives, who employed every stratagem to obstruct my ascent, we left the place on the 15th, and after a four hours' walk reached Mapanya (alt. 3146 ft.). The way led through the forest and cultivated fields of plantains, where an *Erythrina* thickly covered with flowers, but without leaves, looked like masses of flame in the distance, and beautifully adorned the landscape. Before reaching Mapanya I observed the last *Elæis*, which was not above 40 feet high, and had a very dwarfed growth. The natives here are accustomed to climb the palm-trees at break of day, and bring down the palm wine, leaving an empty gourd-flask for the next day. During this employment they make a loud laughing cry, which is repeated from the surrounding trees, and which I can compare to nothing better than to the crowing of cocks. The palm oil is only prepared for household use on the mountain, and the fresh nuts taken out of the spikes are carried to market.

I found the chief Botani an unusually polite man, and very different from the one I had previously seen. He had one of the huts cleaned for me at once, and asked about my requirements. I only wanted water, which he provided for a reward in tobacco. The natives here do not smoke, but snuff all the more; consequently I had provided myself with the latter article, which the people of both sexes 'accepted.' Even children of three or four years took a pinch, which plainly showed the custom to be an old one with them.

On the next morning at daybreak, the chief told me that the guide was ready to go with me up the mountain, whereupon I left the hut, and, to my no small astonishment, found eleven instead of one! I now gave the chief his arms, and made each of the people a present of some clothing and tobacco. I then gave four of my Kroomen orders to go back with Mr. Pinnock to Victoria, and await the arrival of Consul Burton, and return with him. I then left the place, with two of my people, accompanied by eleven natives. First we ascended a few bushy hills with a few trees, and on both sides of the way saw *Saccharum spontaneum*, 8–10 feet high. The *Amomum* had disappeared, and two species of *Impatiens* were common. When we had left behind the last plantation of plantains, we found ourselves in a forest in which I soon recognized the beginning of the fern region, and soon the valleys were seen filled with beautiful *Cyatheas.* The stems of the trees were clothed with *Trichomanes*; and *Dicksonia selinifolia* grew on nearly every stem of *Cyathea. Hypolepis pteridioides* appeared; and a small Orchid, not in flower, grew over the branches of the trees. The soil was covered with a thick clothing of *Selaginella Vogelii* as with a beautiful green carpet, and adorned with the beautiful flower-heads of a *Hæmanthus* 6 inches in diameter, and the less conspicuous but no less beautiful flowers of a species of *Calanthe.*

After an hour's walk through the forest, we reached the end of a lava-stream which flowed from the mountain in a S.S.W. direction. The extremity or basin (?) (alt. 4967 ft.), in which I sank to the loins, and which contained a great quantity of water, was clothed with a small *Nephrolepis*, and the moss, No. 1413. Here the *Ericinella* appeared first, in company with *Leucothoë angustifolia, Rubus apetalus,* and *Clematis Simensis,* on the border of the wood which fringed both sides of the stream. After we had climbed on the lava for an hour, the *Nephrolepis* disappeared, and the moss and lichens, Nos. 1411, 1412, took its place; these, we everywhere found, formed the first vegetation on the lava-field. Near these, two species of Orchidaceæ were observed, which continued for the next five hours, when they were succeeded by *Crassula Mannii.* After the lapse of this time, I saw before me three small hills, of which two were coloured black, and formed the crater from which the lava-stream had flowed. When we reached this, my guides asked me where I would sleep; to which I replied, where I could find water. (Altitude of base of these hills 7309 ft.)

Consequently we made only a short rest here, and passing the base of a row of hills, we reached, after twelve hours' walk, the beginning of a forest at the bottom of a grass-grown crater, and followed a footpath which seemed to be for the use of hunters. I here saw the small *Blæria spicata,* and the other beautiful plants *Hypoxis villosa,* var., and *Sopubia Madagascariensis.*

On approaching the borders of the wood, I saw *Hypericum angustifolium,* and the magnificent plant *Lasiosiphon glaucus,* in full flower. *Pittosporum Mannii* and *Paratropia Mannii* gave the forest a beautiful fresh green, while the other *Paratropia* (*P. elata*) had lost nearly all its leaves, and was just coming into flower.

On entering the forest, I found myself among a mass of flowers which highly delighted me; there was, indeed, scarcely a leaf to be seen. Two Acanthaceæ were loaded with flowers. There was also the leafless *Plectranthus insignis*; and I also saw, for the first time, the third species of *Impatiens* and the various Umbelliferæ of the collection. My portfolio was soon filled, and I left the collecting of most of the plants until another visit.

After penetrating a few hundred paces into the wood, we found a spring which afforded good water in abundance. This was a most fortunate circumstance, as it removed all the difficulties I had dreaded, and made me nearly independent of the natives. (Alt. 7880 ft.) After filling our vessel with water, I wandered about comfortable and happy; and when we had gone half-an-hour's walk further, we came to a small hut, in which some of the natives prepared their beds, while I pitched my tent close by,—the rest of the party going a little further to a hollow, as there was not room enough in the small hut for all. I was only disturbed once in the night by the howling of a hyæna close by my tent, and, after a sound sleep, was awakened in the morning by the laughing cry already mentioned, from the natives in the hollow.

As we proceeded, numerous mountains rose before us, and amongst them one distinguished by its height. Towards this I turned, with the intention of ascending it, but had not reached it when I perceived that nearly all the natives had left me; and the two who remained also refused to go any further. I desired them to await my return, and I went on, with both my Kroomen, to the mountain. When I reached its foot, I saw a still higher one, to which I then turned; but I was for some minutes enveloped in so dense a cloud that I could see nothing around me; moreover, not being able to go much further, since I had no food, and the natives had gone back, I returned to the mountain we had left. Its summit (alt. 9139 ft.) I now climbed, and hung up my self-registering thermometer, and following the natives, who indicated to me the road by the blowing of a cow-trumpet, as the clouds prevented my seeing more than ten paces ahead, I soon reached the top, and turned directly to the lava-field. On that being crossed, I observed, on the borders of the wood, *Cynoglossum micranthum* and the *Adiantum*, No. 1367, and later, on another field of lava, the *Cheilanthes*, No. 1372: *Trifolium Simense*, *Cyanotis Abyssinica*, and a species of *Habenaria* were all dried up. On returning, I found the descent of the lava-stream as difficult and fatiguing as the ascent, and reached Mapanya again at about six in the evening, without shoes, as both the pairs which I had taken with me were completely destroyed by the sharp lava.

On the following afternoon I heard that Europeans were approaching, and saw the principal men very busy in performing certain ceremonies to ward off bad luck. These consisted, first, in pouring water over a small broom on a stone in the middle of the village, and repeating this ceremony on all the roads that led out of the village. The strangers soon appeared, and I was delighted to see not only Consul Burton, but also Mr. Saker and Signor Calvo, the Judge of Fernando Po.

The two following days were consumed in altercations with the natives, and it was not until the morning of the 22nd that we were able to start for the spring previously mentioned, where we intended to leave a great part of our things concealed. Halfway across the lava-stream, Consul Burton pointed out to us a place where, with little labour, water might be found in case of need: this we distinguished as "Burton's well."

When we arrived at the foot of the first crater, finding it impossible to proceed further, we determined to encamp for the night. As we had suffered all day from the want of water, which prevented many of our people from travelling so quickly as ourselves, and we had no hope of their reaching the crater before night, I and some of our attendants went to fetch water; and on returning soon after sunset, found that half of the people had not yet reached the place.

After a cold night, which we passed wrapped in our clothes upon the ashes, at 4 A.M. we sent some of our people again for water; and on their return, all present were despatched to the spring with our baggage, and desired to prepare a sleeping-place. We ourselves waited till 2 P.M. for those who were still missing; but as they had not then arrived, we left the place, leaving behind one man with a supply of water for them. We reached the rendezvous in a quarter of an hour, and the rest of the people arrived at 5 P.M.

On the morning of the 24th we made an excursion to the mountain where I had left my thermometer, and found the reading to be, max. 71¼, min. 39¼. This mountain was named by Mr. Saker "Mount Helen." (Alt. 9450 ft.)

We had splendid weather; and a wonderful panoramic view spread around us—the principal mountain presenting two conspicuous summits, which we named "Mount Victoria" and "Mount Albert." After Consul Burton and Mr. Saker had made their geographical observations, we commenced the descent shortly before noon. During the day I felt very unwell; and as soon as we had returned to our camping-place, and I had put my plants in paper, I was obliged to go to bed. On Christmas Day I was worse, and quite unable to do anything. Mr. Saker left us on that day, promising to return in eight or ten days. On the 27th, Consul Burton and Signor Calvo left in search of a suitable place where water might be provided for an excursion to the summit. When they returned in the evening, I learned that Consul Burton had found time to ascend Mount Victoria; he had unfortunately, however, so injured his foot that he was prevented leaving our encampment for the next four weeks. Until the 30th I was equally unable to move; but on that day I took a stroll, which I repeated on the two following days.

On the 2nd of January, 1862, I felt so well that I set out with Signor Calvo on my first excursion to the summit. We reached Mount Helen shortly after noon, and, after a short rest, directed our steps towards the next high mountain, named by Consul Burton "Mount Isabel." This we reached about 2 P.M.; and while our people prepared a sleeping-place in the crater, we set off to the summit, whence we enjoyed a magnificent view over that part of the range which we had just passed, while in the opposite direction rose Mounts Victoria and Albert, with a number of small hills in front, the formation of which must be ascribed to an earlier period, as the lava-field which surrounded them was formed by eruption from Mount Victoria and Mount Albert. The highest peak of the smaller hills I took the liberty of naming Mount Hooker. On the field which we traversed this day, the few plants which might be termed arborescent were *Leucothoë angustifolia* and *Myrica salicifolia*, Hochst., which reached a height of 20 feet, but only grew scattered in hollows or craters. *Hypericum angustifolium* only occurred as a shrub, not above 6 or 8 feet high. *Cytisus Mannii* was in full splendour, quite covered with flowers, and formed very pretty little trees with round tops. *Helichrysum fœtidum* grew in every direction, and *H. Hochstetteri* peeped out of all the hollows, while *Wahlenbergiæ* rose everywhere above the surface of the grass. *Scabiosa succisa* was here only found on the west side of Mount Isabel. Another small plant, *Umbilicus pendulinus*, grew on the lava-fields. On the following day we left the crater (alt. 10,746 ft.) at 7 A.M., and went round the west side of Mount Hooker; and on the north side, at its base, we found a suitable place to pass the next night. After an hour's rest, we climbed to the summit of Mount Albert, which we accomplished in less than four hours. This western side of the mountain was quite naked, consisting only of ashes, in which one frequently sank two steps backwards for one forwards. When we reached the summit (alt. by Consul Burton's thermometer 13,553 ft.), we found the wind so strong that it nearly blew us down, and at the same time it was so cold (45½°) that it made our tropical hands almost useless. After half-an-hour's stay, we hung up the self-registering thermometer and left the top, too much benumbed by cold for any further observations. We reached the rendezvous about 3 P.M.; but my collection this day was not very rich. Besides the Gramineæ, I found *Helichrysum Mannii*, the above-named Crassulacea, *Swertia Clarenciana*, and *Veronica Mannii*, which all grew on the enormous lava-fields which surround the highest mountain.

I felt very weak and unwell, and soon found that I had a relapse of my previous illness. This induced us, on the following day, to set out on our return. When we reached Mount Isabel, we perceived, on the opposite side of the crater, a native, destitute of clothing, save a piece about the loins, accompanied by two dogs with wooden bells fastened to their necks. I made signs to him to approach us; but this he declined, and soon made off. With the exception of one, our Kroomen were so frightened at his appearance that they took to their heels.

We reached our encampment at 5.30 P.M., and on the following day were joined by Mr. Saker and Mr. Smith, also a missionary. My condition daily became worse, and it was impossible for me to collect. I lay nearly the whole day in my hammock, using every means at hand, but without success. While Consul Burton was prevented walking by his wounded foot, Messrs. Saker and Smith fell ill of fever; so that we were a pitiful company for mountain research.

On the 9th I concluded to turn back to Victoria, and on the following day was carried down by my men, as I was too weak to go on foot. Mr. Smith returned on the 15th, suffering much from fever; and on the following day, Mr. Saker, having been to the summit two days previously. On the morning of the 22nd we had a tornado; and when it had passed over, we observed snow on the north-east side of the mountain. Having re-established my health, I again left Victoria on the 24th, and reached the forest beyond Mapanya in the evening. Next day I climbed, for the third time, the lava-stream, and reached, early in the afternoon, Consul Burton's encampment, where I learned that on the previous day he had set out on an excursion. The following day he visited the hollows before mentioned; and on the 27th we climbed to the summit for the last time. After we had reached Mount

Isabel and had rested, Consul Burton climbed to the top and made his observations, while I completed a sketch and collected till 5 P.M. We slept in the crater of this mountain, and on the next day went to a small crater where Mr. Saker had previously had his resting-place. After enjoying ourselves a little, we went to the principal peak, and, when we had reached it, turned to the east in order to have a view in a north-east direction. On reaching the shoulder of the mountain, we again found ourselves upon an extended lava-field, with the crater of Mount Victoria straight before us. While I made a sketch of it, Consul Burton went towards it; and I followed a little more to the eastward, where I, for the first time, saw the north-east direction of the range, which looked like a plain. When I reached the crater, I found it was much larger than any I had before seen, being considerably larger than that of the peak of Fernando Po. The absence of our people prevented Consul Burton from making the observations he intended. I found on the eastern side much more of interest than on the west, as it was more or less covered with vegetation to the top. I found, amongst other things, the pretty erect *Lycopodium*, No. 1410, of the collection, the very pretty Composite *Senecio Burtoni*, H. f., and *Anthospermum asperuloides*. *Helichrysum Mannii* grew everywhere at the bottom of the mountain, and on this side extended to the top. The *Ericinella* and the *Cytisus* both reach to the middle of the mountain. Mount Albert is, without doubt, of more recent formation than Mount Victoria, or it would be clothed with more luxuriant vegetation than the latter, as the wind is nearly always N.E., and I have always observed the vegetation to be far poorer on the side exposed to it. On the next day I visited this side again, and added some mosses to my collection, while Consul Burton visited the Prince's and Albert craters, and employed himself in measuring the distances. After I had again ascended Mount Victoria, and had made drawings of the two craters mentioned above, and of Mount Albert, I set off to the latter to fetch the thermometer; but to my sorrow I found it in a very different place to that in which I had left it, hanging only on one hook, and with the bulb uppermost, the spirit having changed from a red to a pale yellow colour. By this misfortune I lost the result of a month, and must be content with daily observation. After having rearranged it, and taken a good view of the unvisited mountain-chain to the north-east, I set off towards the crater, where I met Consul Burton, who had sent his servant to erect the British flag on Mount

Victoria. We then emptied a bottle of champagne in honour of the day, and again separated, I to descend to our resting-place, and Consul Burton to climb Mount Albert. When he returned, I learned that he had found crevices from which smoke was issuing. On the next day I again climbed Mount Victoria (alt. by Consul Burton's thermometer 13,270 ft.), and then went to Mount Albert and fetched the thermometer. I found the max. temp. 55°, the min. 27°, and the temperature, at the time of my return, 35°. I then visited the chinks to ascertain the temperature in them, which I found to be *lower* than outside: no smoke was issuing from them. From this I set out to Mount Hooker, at the base of which I boiled the thermometer (alt. 10,856 ft.), and then ascended and repeated the operation at the top (alt. 12,271 ft.), and returned.

While the north-east side of the latter mountain is covered with the very pretty grass *Deschampsia cæspitosa,* which forms masses of 2–3 feet diameter and 2 feet high, I found the south-west side entirely clothed with *Hypericum, Ericinella, Cytisus,* and *Helichrysum chrysocoma.*

On the way to Mount Isabel I was enveloped in such thick clouds that I could only see one or two steps in advance, which made the road, which in fine weather is difficult, very disagreeable, as one could not see the many holes until upon the margin of them. When I had reached Mount Isabel the weather cleared, and I set off to the principal encampment, where Consul Burton informed me that there had been a heavy shower of hail during the day; heavy rain had also fallen at the camp, and wetted most of the things we had left.

At noon on the 31st of January, Consul Burton and his people left for Victoria. The weather considerably improved; and a hurricane, which blew down some old trees near the camp, was the only noteworthy incident of the day.

On the following day I was busily engaged in collecting the pretty *Brucea antidysenterica,* sheltered in a hollow from the strong wind, when I suddenly observed a native close by, who, without seeing me, had unwittingly dropped upon me. When I addressed him, he stretched out his head, and after a few minutes pronounced the word "tobacco." I called to him to come nearer, which he was unwilling to do; and when I went towards him, I saw that he trembled with fright. He was a head taller than I, and nearly twice as stout, without any clothes except a small piece of thin cloth about his loins; he had a cutlass and other arms. I made him understand that he should bring me a hyæna and a gazelle, which he promised, and slowly went away, looking back as though afraid that I should lay hands upon him.

On the 2nd of February I left the camp early in the morning, went towards Mount Helen, made a sketch of Mount Isabel, and turned towards the eastern peak, Mount Eliza, which lies on the border of the ascending lava-field and the wood which reaches to the sea. In fact, half of it is in the wood and half above it, while the southern part and the crater are covered with a thick growth of trees. From the top I had before me the most beautiful panorama which I had hitherto seen, beginning with Mount Victoria, and ending with the "Black Crater." I traced it on paper, noted the direction of the various mountains, and then set out on my return to the encampment, following a footpath which from the north-east side of the mountain runs north-west from Mount Eliza, west-south-west from Mount Helen, through Calvo's Crater to the west side of the mountain. From the depth to which the path is worn, it would seem that it must serve as a communication between the inhabitants of the west and those of the north-east side of the mountain, as the hunters who would visit the mountain by this path are very few.

When I approached the rendezvous in the evening, I saw the north side of the mountain on fire, which the high wind favoured and quickly spread over the mountain.

On the 13th I left the place, with my people, and reached the forest a little above Mapanya late in the evening (Ridge Camp, alt. 4284 ft.). I spent four days at this place, of which two, from the very heavy rain, were almost lost. On the 14th the thunder began at 5 A.M., and lasted till 4 P.M.; and in the middle of the day it was so dark that the screech-owls and large bats left their hiding-places, and announced their presence by their unpleasant cries. I, however, succeeded in collecting all the plants I wished, and among them a beautiful *Mussænda* and two species of *Oncoba*. On the afternoon of the 17th, when upon an excursion downwards, I met Mr. Smith and Mr. Pinnock, who had been good enough to come in case Botani should have any unfriendly intentions; they had, however, found him very well satisfied, and we passed Mapanya, the next day, without meeting with any disturbance, and reached Victoria in the afternoon.

After packing my plants, I left Victoria on the 24th, in company with Mr. and Mrs. Saker and Mr. Smith, in a boat of the mission, and reached the Cameroon river at 3 A.M. on the following morning, intending to return to Fernando Po by the next steamer.

I owe many thanks to Mr. and Mrs. Saker and Mr. Smith, who here, and especially in Victoria, have always assisted me with the greatest kindness and politeness, thus removing many of the disagreeables connected with the expedition.

In the trust that the result of this expedition may meet your approval, and that the flora of the mountains of west tropical Africa may thereby become known to science,

I have the honour to remain, &c., &c., &c.,
G. MANN.

Cameroons, February 27, 1862.

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## An Enumeration of the Species of *Acanthaceæ* from the Continent of Africa and the adjacent Islands. By THOMAS ANDERSON, M.D., F.L.S., Officiating Superintendent of the Royal Botanic Gardens, Calcutta.

[Read June 5, 1862.]

IN this enumeration, I have followed the classification I proposed in my monograph of the Cingalese species of Acanthaceæ, published in Thwaites's 'Enumeratio Plantarum Zeylaniæ.' The principal feature of that arrangement is the subdivision of the Order into two great Suborders, *Ruellideæ* and *Acanthideæ*, distinguished from each other by the character of the æstivation of the corolline lobes, and into a third small but well-marked group, separated from the other two by the nature of the calyx, and also by the peculiar placental processes of the seeds. I shall reserve some remarks on the limits of the genera and the geographical distribution of the African species for the general revision of the Order, which I hope to submit to the Society at an early date.

### CONSPECTUS GENERUM.

### Subordo I. THUNBERGIDEÆ.

*Calyx ad annulum carnosum, integrum vel pluridentatum reductus. Corollæ lobi æstivatione contorti. Semina cupula suffulta.—Plantæ volubiles, raro prostratæ.*

1. THUNBERGIA. *Calyx* inconspicuus, bracteis duabus magnis occultus.

## Subordo II. RUELLIDEÆ.

*Calyx herbaceus, 5-, raro 4-partitus. Corollæ lobi æstivatione contorti. Semina retinaculo uncinato (vel papilla) suffulta.—Plantæ non volubiles.*

### Tribus I. NELSONIÆ.

*Calyx parvus, herbaceus. Semina minuta, globosa, papilla parva suffulta.—Herbæ neglectæ.*

† *Corolla infundibuliformis.*

2. ELYTRARIA. *Stamina* antherifera 2; sterilia 2.—*Herbæ* acaules. *Scapi* folia squamæformia, adpressa.

3. NELSONIA. *Stamina* 2, sterilia nulla.—*Herbæ* caulescentes.

†† *Corolla 2-labiata.*

4. ADENOSMA. *Stamina* 2, in specie Africana.

### Tribus II. RUELLIEÆ.

*Calyx parvus, herbaceus. Semina conspicua, compressa, retinaculo uncinato suffulta.*

### Subtribus I. HYGROPHILEÆ.

*Corolla 2-labiata. Capsula polysperma, valvis striatis vel sulcatis.*

† *Capsula linearis, compressa, a basi ad apicem seminifera.—Flores laxe paniculati.*

5. BRILLANTAISIA. *Stamina* fertilia 2.

6. NOMAPHILA. *Stamina* fertilia 4.

†† *Capsula teretiuscula vel oblonga, a basi ad apicem seminifera.—Flores verticillati.*

7. HYGROPHILA. *Antheræ* muticæ, ovatæ.

### Subtribus II. EURUELLIEÆ.

*Calyx herbaceus. Corolla infundibuliformis. Capsula basi sterilis, supra medium seminifera.*

† *Bracteæ minutæ vel nullæ. Capsula subteres.*

8. CALOPHANES. *Corolla* recta. *Antheræ* basi 2-calcaratæ. *Capsula* linearis, acuta, apice 4-sperma.

9. Ruellia. *Corolla* recta vel curvata. *Antheræ* muticæ. *Capsula* apice tumida, subglobosa, polysperma.

†† *Bracteæ 2, magnæ, corollam tegentes. Capsula obovata, basi breviter constricta, a dorso compressa.*

10. Petalidium. *Bracteæ* membranaceæ. *Calyx* 5-partitus. *Corolla* in æstivatione bracteis 2 magnis occulta. *Flores* solitarii.

11. Pseudobarleria. *Bracteæ* subherbaceæ. *Calyx* 4-partitus. *Flores* in cymulis lateralibus.

††† *Bractea 1 magna; bracteolæ 2, breviores.*

12. Phaylopsis. *Calyx* inæqualiter 5-partitus. *Flores* dense spicati.

### Tribus III. Trichantheræ.

*Calyx amplus, coloratus vel membranaceus.*

13. Whitfieldia. *Bracteæ, bracteolæ* et *calyx* colorata. *Corolla* infundibuliformis. *Ovarium* 4-ovulatum. *Semina* 4, magna, subdiscoidea; retinaculis apice bidentatis.

## Subordo III. ACANTHIDEÆ.

*Calyx herbaceus,* 5-, *raro 4-partitus. Corollæ lobi æstivatione imbricati vel imbricato-bilabiati. Semina retinaculo uncinato suffulta.*

### Tribus I. Barlerieæ.

*Corolla hypocraterimorpha vel infundibuliformis; lobis in æstivatione imbricatis (in* Lepidagathide *bilabiatis*).

Sect. 1. *Corollæ lobi æstivatione imbricati.*

† *Antheræ biloculares.*

14. Barleria. *Calyx* 4-partitus. *Corolla* regulariter infundibuliformis vel hypocraterimorpha. *Stamina* 2 vel 4 antherifera, cum 1 seu 3 sterilibus brevioribus.

15. Crabbea. *Calyx* 5-partitus. *Corolla* campanulata. *Stamina* 4. *Ovula* 4–8.

16. Lankesteria. *Calyx* 5-partitus. *Corolla* oblique hypocraterimorpha. *Ovula* 4.

†† *Antheræ uniloculares.*

17. Crossandra. *Calyx* 5-partitus. *Corolla* hypocraterimorpha.

Sect. 2. *Corollæ lobi æstivatione bilabiati.*

18. LEPIDAGATHIS. *Calyx* 5-partitus. *Stamina* 4; antheris bilocularibus.

### Tribus II. ACANTHEÆ.

*Corolla unilabiata; lobis 3 vel 5, medio exteriore. Stamina 4; antheris unilocularibus.*

† *Calyx cruciatim 4-partitus.*

19. BLEPHARIS. *Corolla* tubo brevissimo. *Calyx* lacinia superiore integra 3-nervia, inferiore 2-nervia. *Capsula* valvis membranaceis.

20. ACANTHOPSIS. *Corolla* tubo elongato. *Calyx* lacinia superiore obsolete 6-nervia, inferiore 6-nervia.

21. ACANTHUS. *Corolla* tubo brevissimo. *Calyx* lacinia superiore 4–plurinervia. *Capsula* valvis chartaceis.

†† *Calyx 5-partitus.*

22. SCLEROCHITON. *Calyx* scariosus, evenius. *Corolla* limbo 5-lobato.

### Tribus III. JUSTICIEÆ.

*Corolla bilabiata. Stamina fertilia 2, loculis plus minus superpositis.*

#### Subtribus I. EUJUSTICIEÆ.

*Corolla tubo non elongato, recto; labio inferiore trifido, lobo medio lateralibus majore; labio superiore brevissime bidentato. Stamina 2.*

Sect. 1. *Calyx 5-fidus.*

† *Capsula dehiscens, simpliciter bivalvis.*

23. DUVERNOIA. *Corolla* labio superiore concavo, compresso, margine et apice incurvo, galeato; inferiore plano. *Stamina* exserta; antheris bilocularibus, muticis.

24. JUSTICIA. *Corolla* labio superiore concavo, non galeato; inferiore convexo, rugoso. *Stamina* antheris bilocularibus, loculo inferiore calcarato.

25. SCHWABEA. *Corolla* labio superiore concavo; inferiore plano, basi gibbulis 2 notato. *Semina* abortu 2, orbiculata, barbata.

26. MONOTHECIUM. *Corolla* labio inferiore breviter trilobo, plano. *Stamina* antheris unilocularibus.

27. ECTEINANTHUS. *Corolla* labio superiore angusto, bidentato; inferiore convexo reticulato. *Stamina* antheris bilocularibus muticis; loculis subtransversim apice inserta.

†† *Capsula parietibus membranaceis, dehiscentia ruptis; placentis a valvis secedentibus.*

28. RUNGIA. *Corolla* labio inferiore biplicato. *Spica* quadrifariam dense bracteata.

Sect. 2. *Calyx* 4-*fidus.*

29. ANISOSTACHYA. *Calyx* bilabiatus; labiis bipartitis. *Corolla* labio superiore plano; inferiore convexo, medio venoso.

### Subtribus II. DICLIPTEREÆ.

*Corolla tubo elongato, recto vel resupinato; labio inferiore lobo medio maximo, lateralibus linearibus. Bracteæ, excl.* Rhinacantho, *calyce multo majores.*

† *Corolla tubo resupinato.*

30. DICLIPTERA. *Capsula* abbreviata; placentis cum retinaculis in dehiscentia solubilibus.

31. PERISTROPHE. *Capsula* elongata; placentis valvis persistentibus.

†† *Corolla tubo recto.*

32. HYPOESTES. *Bracteæ* tetraphyllæ. *Calyx* laciniis coalitis. *Stamina* antheris bilocularibus. *Flores* in capitulis 3- vel unifloris.

33. RAMUSIA. *Stamina* inclusa; antheris unilocularibus. *Flores* non spicati.

34. BRACHYSTEPHANUS. *Stamina* exserta; antheris unilocularibus. *Flores* spicati.

35. RHINACANTHUS. *Calyx* 5-partitus. *Corolla* longe tubulosa; limbo bilabiato. *Stamina* antheris bilocularibus. *Flores* paniculati; bracteis parvis, subulatis.

### Subtribus III. GRAPTOPHYLLEÆ.

*Corolla tubo abbreviato, dilatato; labio inferiore lobis subæqualibus. Stamina 2 vel 4. Bracteæ parvæ vel nullæ.*

† *Stamina* 2.

36. GRAPTOPHYLLUM. *Stamina* antheris bilocularibus. *Stylus* inclusus. *Bracteæ* minutæ. *Folia* variegata.

†† *Stamina* 4, 2 *ananthera.*

37. HAPLANTHERA. *Antheræ* uniloculares, basi mucronatæ. *Stylus* longus, exsertus. *Flores* axillares, solitarii. *Bracteæ* minutæ.

38. RUTTYA. *Antheræ* uniloculares, basi muticæ. *Flores* spicati.

### Tribus IV. ASYSTASIEÆ.

*Corolla infundibuliformis vel raro hypocraterimorpha, æstivatione bilabiata. Stamina 4, sæpe 2 sterilia vel ananthera.*

### Subtribus I. ERANTHEMEÆ.

*Corolla hypocraterimorpha; lobis subæqualibus.*

39. ERANTHEMUM. *Stamina* 2, cum rudimentis 2 sterilium; antheris bilocularibus, loculis plus minus divaricatis muticis.

### Subtribus II. EUASYSTASIEÆ.

*Corolla infundibuliformis; lobis æqualibus.*

40. DICENTRANTHERA. *Stamina* 4, didynama, omnia fertilia; antheris loculis basi bicalcaratis.

41. ASYSTASIA. *Stamina* 4, omnia fertilia; antheris loculis basi mucronatis.

42. MACKAYA. *Stamina* 4, 2 ananthera; antheris loculis muticis.

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## I. THUNBERGIA, *Linn. fil.*

### Sect. 1. *Calycis limbus truncatus.*

1. T. NATALENSIS, *Hook. Bot. Mag.* t. 5082.

*Hab.* Prope Maritzburg in Natal provincia Africæ austro-occidentalis, *Sanderson! in herb. Hook. et herb. Harvey.*

2. T. CHRYSOPS, *Hook. Bot. Mag.* t. 4119; *N. ab E. in DC. Prod.* xi. p. 55.

*Hab.* Ad Sierra Leonė, *Whitfield! in herb. Hook.*

3. T. GERANIIFOLIA, *Benth. in Fl. Nigrit.* p. 475.

*Hab.* Ad Sierra Leone, *Vogel! in herb. Hook.*; *Wilford in herb. nostr.*

4. T. VOGELIANA, *Benth. l. c.* p. 476.

*Hab.* In insula Fernando Po, *Vogel! in herb. Hook.*

5. T. ERECTA, *T. Anders.*—Meyenia erecta, *Benth. l. c.* p. 476.

*Hab.* Ad Cape Coast in Africa occidentali tropica, *Vogel! in herb. Hook.*

### Sect. 2. *Calycis limbus pluridentatus.*

6. T. CYNANCHIFOLIA, *Benth. l. c.* p. 475.

*Hab.* Ad ripas fluvii "Quorra," *Vogel* ! *in herb. Hook.*

7. T. KIRKIANA, *T. Anders.* Scandens, strigoso-hirsuta; foliis lanceolatis, acutis, basi acute hastatis, integris, trinerviis, utrinque scabro-hirsutis; pedicellis axillaribus, unifloris; bracteis ovato-lanceolatis, longe acuminatis, plurinerviis; calyce 6–7-fido.

*Hab.* Prope "Satohi" in Africa orientali tropica, ad altitudinem 3000 ped., *Kirk* !

*Suffrutex* 1–2-pedalis. *Caules* lignosi, subteretes. *Rami* herbacei, angulati, volubiles. *Folia* 1–2 unc. longa, basi ½–1 unc. lata, valde et acute hastata, pilis strigosis hirsuta. *Pedicelli* plerumque folia superantes, erecti. *Bracteæ* fere 1 unc. longæ, herbaceæ, 5–6 nerviæ, extus strigoso-hirsutæ, intus glabræ. *Corollæ* tubus 1 unc. longus, incurvus; limbus amplus, profunde 5-fidus, lobis subæqualibus, rotundato-ovatis. *Corolla* pallide lutea, fauce purpurea.

This species resembles some of the hastate-leaved forms of *T. fragrans*, Roxb., but it is easily distinguished from them by its long-pointed bracts and 3-nerved leaves.

8. T. ALATA, *Bojer, in Hook. Exot. Fl.* t. 17; *N. ab E. in DC. l. c.* p. 58.

*Hab.* In oris Africæ orientalis ad lat. 5°–6° austr., *Forbes* ! *in herb. Hook.*; in pratis humidis insularum Zanzibar et Tombæ in ora orientali Africæ, *Bojer* ! *in herb. Hook.*

9. T. ANGULATA, *Hils. et Bojer in Hook. Exot. Fl.* t. 166 et 177. f. 3, 4, 5.

*Hab.* In Africa australi, *Drège* ! *in herb. Hook. et Sonder*; in insula Madagascar, *Bojer* ! *in herb. Hook.*

*Distr.* In India orientali, sed certe non spontanea.

10. T. LANCIFOLIA, *T. Anders.* Caule erecto, subtereti, bisulcato, striato; foliis sessilibus, lanceolatis, acuminatis, mucronulatis; pedicellis axillaribus, solitariis, unifloris; bracteis ovato-lanceolatis, acutis, reticulato-venosis; calyce carnoso, incrassato, limbo paucidentato, dentibus inæqualibus breviter subulatis; corolla recta, tubo abbreviato, fauce amplo, limbi lobis æqualibus; staminibus 4, didynamis, antheris bilocularibus, 2 basi et apice aristatis, 2 apice solum aristatis; stigmate infundibuliformi, trigono. Capsulam non vidi.

*Hab.* In arvis ad altitudinem 2500 ped., prope Tshinsunze in Africa orientali tropica, *J. Kirk* !

*Herbacea,* erecta vel subvolubilis. *Rami* striati. *Folia* sessilia, acuminata, 1–3 unc. longa, ¼–½ unc. lata. *Pedicelli* proanthesin plus minus deflexi, apice paulo incrassati, ½–1 unc. longi. *Bracteæ* coriaceæ. *Corolla* recta, ampla, 1¼ unc. longa, flava, fauce purpurea.

11. T. DRÈGEANA, *N. ab E. DC., l. c.* p. 58.
*Hab.* Ad Uitenhage in promont. Bonæ Spei, *Drège* ! *in herb. Hook., Sonder, et Harvey.*

12. T. ATRIPLICIFOLIA, *E. Meyer, in herb. Drège.*—T. Drègeana, *N. ab E. in herb. Hook.* partim.—T. aspera, *N. ab E., DC., l. c.* p. 56.
*Hab.* In promont. B. Spei, *Drège* ! *in herb. cit.*; Port Natal, *Krauss in herb. Hook.*

13. T. NEGLECTA, *Sond. in Linnæa,* xxiii. p. 89.—T. hirta, *Sond. l. c.* p. 88.—T. Drègeana, *N. ab E. in herb. Hook.* partim.
*Hab.* In promont. B. Spei, *Drège* !, *herb. Ecklon et Zeyher* !

14. T. CAPENSIS, *Thunb. Prod. Fl. Cap.* p. 106.
*Hab.* In Africa australi, *Drège* ! *Sanderson* ! *in herb. Hook.*; *in herb. Ecklon et Zeyher* !

15. T. RETICULATA, *Hochst. in Schimp. Pl. Abyss.* n. 758; *DC. l. c.* p. 58.
*Hab.* In Abyssinia, *Schimper* !

16. T. ANNUA, *Hochst. in Kotsch. Pl. Nub.* n. 109; *DC. l. c.* p. 55.
*Hab.* In Nubia et Abyssinia, *Kotschy* !

17. T. HIRSUTA, *T. Anders.* Subprostrata, hirsuta; foliis subsessilibus, triangularibus vel ovato-lanceolatis, basi rotundatis vel subcordatis, 5-nerviis, margine sinuato-dentatis; pedicellis erectis, axillaribus, elongatis, unifloris; bracteis reticulatis, ovato-lanceolatis, acutis, basi cordatis; calyce 12-fido; corollæ tubo basi constricto, superne ventricoso, multum incurvo.
*Hab.* In Abyssinia, *Plowden* ! *in herb. Hook.*
*Caules* subprostrati, subteretes, pilis patentibus hirsuti. *Folia* 1–1½ unc. longa, 1 unc. lata, herbacea, hirsuta. *Pedicelli* 3 unc. longi, axillares, uniflori, hirsuti. *Bracteæ* 1¾ unc. longæ, ¾ unc. latæ, reticulato-nerviæ, extus submolliter tomentosæ, intus glabræ. *Corollæ* tubus 1½ unc. longus, basi constrictus, ad medium ventricosus, ad faucem paulo constrictus; limbus subcoriaceus, lobis parvis, subæqualibus. *Capsula* glabra.

### II. ELYTRARIA, *Vahl.*

1. E. CRENATA, *Vahl. En.* i. p. 106.—E. marginata, *Pal. de Beauv. in Vahl. En.* i. p. 108.—E. virgata, *N. ab. E., DC. Prod.* xi. p. 63.
*Hab.* In insula Fernando Po, *Vogel* ! *Mann* ! *in herb. Hook.*; insula St. Thomas, *Don* !; Tette et Senna prope flumen Zambese, *Kirk* !
*Distr.* In regionibus calidioribus Americæ borealis, atque in Asia tropica.

### III. NELSONIA, *R. Br.*

1. N. TOMENTOSA, *Willd. Sp. Pl.* ed. 2, p. 419.—N. rotundifolia, *R.Br. Prod. Fl. Nov. Holl.* i. p. 481.—N. nummulariæfolia, *Roem. et Sch.*

*Syst.* i. p. 173.—N. Pohlii, *N. ab E. in Endl. et Mart. Fl. Bras.* fasc. vii. p. 15.—N. canescens, *N. ab E., DC. Prod.* xi. p. 67.

*Hab.* In Africa tropica vulgatissima, *Vogel* ! *Barter* ! *Mann* ! *et Kirk* ! *in herb. Hook.*; in insula Madagascar, ad Warrow-voai Bombatooka, *Bojer* ! *in herb. cit.*

*Distr.* Herba neglecta per totum orbem calidiorem.

## IV. ADENOSMA, *N. ab E.*

1. A. AFRICANA, *T. Anders.* Foliis submersis pinnatifidis, superioribus petiolatis, obovato-spathulatis, integris; floribus in verticillis paucifloris; corolla calycis segmentis breviore, alba; staminibus 2; ovario multiovulato.

*Hab.* Prope "Nupe," ad ripas fluminis "Quorra," *Barter* ! *in herb. Hook.*

## V. BRILLANTAISIA, *Pal. de Beauv.*

1. B. OWARIENSIS, *Pal. de Beauv. Fl. Owar. et Ben.* ii. p. 68, t. 100. f. 2.—B. Lamium, *Benth. in Fl. Nigrit.* p. 477.—Belantheria Belvisiana, *N. ab E., DC. Prod.* xi. p. 97.—Leucoraphis Lamium, *N. ab E. l. c.*

*Hab.* In Sierra Leone, *Whitfield* !; in insula Fernando Po, *Vogel* ! *Barter* ! *Mann* ! *in herb. Hook.*

2. B. PATULA, *T. Anders.* Caule erecto; foliis ovatis, acutis, in petiolo decurrentibus, serratis; floribus in ramulis distichis axillaribus, divaricatis, patulis; calycis laciniis capsulam fere æquantibus, apice obtusis, reflexis; capsula apice acuta.

*Hab.* In Congo, *Christian Smith* ! *in herb. Hook. ex herb. R. Brown.*

*Suffrutex* erectus, glanduloso-tomentosus. *Caulis* tetragonus, sulcatus, ad nodos tumidus. *Ramuli* floriferi 6–8 unc. longi, laterales, multiflori, dichotome ramosi. *Calycis* laciniæ vix 1 unc. longæ, lineares, obtusæ, glanduloso-hirsutæ. *Capsula* 1 unc. longa, pilis glandulosis sparsissime obtecta, polysperma.

3. B. VOGELIANA, *Benth. in Fl. Nigrit.* p. 477.

*Hab.* In insula Fernando Po, *Vogel* ! *in herb. Hook.*

## VI. NOMAPHILA, *Blume.*

1. N. LÆVIS, *N. ab E. in DC. Prod.* xi. p. 85.

*Hab.* In Senegambia, *Heudelot* !; in locis paludosis prope "Nupe," in Africa occidentali tropica, *Barter* ! *in herb. Hook.*

2. N. CILIATA, *T. Anders.* Caule erecto, 4-angulari, nodis incrassatis, fimbriato-ciliatis; foliis sessilibus, lanceolatis, basi cordatis, glabris, integris; cymis axillaribus, paucifloris, foliosis; pedicellis filiformibus, glanduloso-hirsutis; calycis laciniis glanduloso-tomentosis; corollæ tubo calyce multo breviore.

*Hab.* In Congo, *Smith* ! *in herb. Hook.*

*Herba* pedalis, erecta, subglabra. *Folia* 1–1½ unc. longa, ½ unc. lata. *Calyx* 3 lin. longus. *Corolla* 4 lin. longa, purpurea. *Ovarium* multiovulatum.

3. N.? Lyalliana, *T. Anders.*—Echinacanthus Lyallianus, *N. ab E.*, *DC. l. c.* p. 168.

*Hab.* In insula Madagascar, *Lyall*! *in herb. Hook.*

I have seen so imperfect a specimen of this plant that I am in doubt about the genus. It has certainly no affinities with *Echinacanthus*, from which the form of the capsule distinguishes it.

## VII. Hygrophila, *R. Br.*

1. H. Senegalensis, *T. Anders.*—Physichilus Senegalensis, *N. ab E.*, *DC. Prod.* xi. p. 81.

*Hab.* In Senegal et Senegambia, *Heudelot*! *in herb. Hook.* nn. 139 et 2838.

2. H. odora, *T. Anders.*—Polyechma odorum, *N. ab E. in DC. l. c.* p. 88.

*Hab.* In Senegambia, *Heudelot*, n. 807 *in herb. Hook.*!, *in herb. Mus. Paris.*

3. H. cærulea, *T. Anders.*—Polyechma cæruleum, *Hochst. in Flor. Ratis.* 1841, i. p. 376.

*Hab.* In Nubia, ad ripas fluminis Nili, *Schimper*! *in herb. Hook.*

4. H. micrantha, *T. Anders.*—Polyechma micranthum, *N. ab E. l. c.* p. 83.

*Hab.* In Senegal, *Perrottet*; ad Dagana in Senegambia, *Leprieur*! *in herb. Mus. Paris.*

5. H. Abyssinica, *T. Anders.*—Polyechma Abyssinicum, *Hochst. in Schimp. Pl. Abyss.*

*Hab.* In Abyssinia, *Schimper*; in regno Sennaar, *Kotschy*, n. 293!

6. H. barbata, *T. Anders.*—Physichilus barbatus, *N. ab E. l. c.* p. 82.

*Hab.* In Senegambia, *Heudelot*, n. 573 *in herb. Hook.*!

7. H. lutea, *T. Anders.* Erecta, scabra; caule obsolete tetragono, supra nodos tumido; foliis sessilibus, linearibus, acutis, integris, pilis rigidis asperis; floribus in verticillis axillaribus, densis, subglobosis; calycis laciniis longe lineari-subulatis, setis hyalinis ciliatis.

*Hab.* Ad ripas fluminis "Quorra," prope "Onitohe," *Barter*! *in herb. Hook.*

*Annua*?, 1–2-pedalis, pilis rigidis patentibus scabra, pauce foliata. *Folia* 2–5 unc. longa, ¼ unc. lata, linearia, acuta, basi attenuata, utrinque aspera. *Corolla* parva, lutea.

8. H. spinosa, *T. Anders. in Thwaites, Enum. Pl. Zeyl.* p. 225.—Asteracantha longifolia, *N. ab E. in DC. l. c.* p. 247, *cum syn.*—A. auriculata, *N. ab E. l. c.* p. 248.—A. macrantha, *Hochst. in Schimp. Pl.*

*Abyss.* n. 343.—Barleria macrantha, *R. Br. in Salt, Abyss. App.*—B. auriculata, *Schumach. Pl. Guin.* p. 285.

*Hab.* In paludibus locisque humidis per Africam tropicam, ad Lagos et Nupe, *Barter*!; in Senegambia, *Heudelot*!; Abyssinia, *Schimper*! *Plowden*!; Nubia, *Kotschy*!; oris Mozambique, *Forbes*! *in herb. Hook.*

*Distr.* Per Indiam orientalem et insulas.

## VIII. CALOPHANES, *Don.*

1. C. RADICANS, *T. Anders.*—Ruellia radicans, *Hochst. in Schimp. Pl. Abyss.* nn. 17 et 177.—Dyschoriste radicans, *N. ab E. in DC. Prod.* xi. p. 106.

*Hab.* Prope Adoam in Abyssinia, *Schimper*! *in herb. Hook.*

2. C. MULTICAULIS, *T. Anders.*—Ruellia multicaulis, *Hochst. l. c.* n. 43.—Dipteracanthus dejectus, var. β, *N. ab E.* partim, *l. c.* p. 125.

*Hab.* In "Scholoda" monte Abyssiniæ, *Schimper*! *in herb. cit.*

3. C. PERROTTETII, *N. ab E. in DC. l. c.* p. 111.

*Hab.* Prope Fassokal in Nubia, ad lat. 11° bor., *Kotschy*! *in herb. Hook.*; ad ripas fluminis "Oti" dicti tributarii "Quorra," *Barter in herb. cit.*

4. C. NATALENSIS, *T. Anders.*—Linostylis ovata, *Sond. in Linnæa,* xxiii. p. 94.

*Hab.* Ad Port Natal in Africa australi, *Gueinzius*! *in herb. Sonder.*

5. C. HEUDELOTIANUS, *N. ab E. in DC. l. c.* p. 112.

*Hab.* In Senegambia, *Heudelot,* nn. 144 et 190 *in herb. Hook.*!

6. C. SIPHONANTHUS, *N. ab E. in DC. l. c.* p. 112.—Ruellia siphonantha, *Hils. et Bojer in herb. Hook.*

*Hab.* In versuris agrorum Emirnæ, provinciæ insulæ Madagascar, *Bojer*!

7. C. MAURITIANUS, *T. Anders.*—Justicia repens, *Neraud. in herb. Hook.*

*Hab.* In insula Mauritii, *Neraud.*! *in herb. cit.*

8. C. GRACILIS, *N. ab E. in DC. l. c.* p. 111.

*Hab.* In insula Madagascar, *Lyall*!

9. C. PERSOONII, *T. Anders.*—Chætacanthus Persoonii, *N. ab E. in Linnæa,* xv. p. 356.—C. glandulosus, *N. ab E. in DC. l.c.* p. 462. —Eranthemum obovatum, *E. Meyer. Cat. Pl. Drège.*

*Hab.* Africa australi, in collibus Kurrolike, *Burke*! *in herb. Hook.*; prope Uitenhage, *Drège*!

10. C. COSTATUS, *T. Anders.*—Chætacanthus costatus, *N. ab E. in DC. l. c.* p. 462.

*Hab.* In Africa australi, ad Macalisberg, *Burke*! *in herb. Hook.*

11. C. Burkei, *T. Anders.*—Chætacanthus Burchellii, *N. ab E. in DC. l. c.* p. 462.

*Hab.* Ad "Thaba Unce" in Africa australi, ad lat. 31° austr., *Burke*! *in herb. Hook.*

Nees von Esenbeck named this species after the traveller Burchell, who he supposed had collected it. This, however, was an error, as the plant has been found only by the collector Burke, whose name therefore it ought to bear.

12. C. setosus, *N. ab E. in DC. l. c.* p. 112.

*Hab.* Prope flumen Aapges, *Burchell*; ad Graham's Town in Africa australi, *in herb. Hook.*!

### IX. Ruellia, *Linn.*

1. R. patula, *Jacq. Misc.* ii. p. 358.—Ruellia matutina, *Hochst. et Steud. Pl. Ægyp.* n. 874.—Dipteracanthus patulus, *N. ab E. in DC.* xi. p. 126.

*Hab.* In Sennaar, *Kotschy*, n. 119!; at Elephants' Bay in Benguela, *Curror*! *in herb. Hook.*

*Distr.* In Arabia felici! India orientali! Ceylania!

2. R. prostrata, *Poir. Enc. Méthod.* vi. p. 349.—Dipteracanthus prostratus, *N. ab E. in Wall. Pl. As. rar.* iii. p. 81.—D. dejectus, *N. ab E. l. c.* p. 82.

*Hab.* In monte "Meeramballa" dicto, atque inter Lupata et Sena, prope fluvium Zambesi, *Kirk*!

*Distr.* In India orientali! et Ceylania!

3. R. cyanea, *Bojer in herb. Hook.*—Dipteracanthus cyaneus, *N. ab E. in DC. l. c.* p. 121.

*Hab.* In insula Madagascar, ad ripas fluminis Chazok, *Bojer*, n. 120 *in herb. Hook.*!

4. R. monanthos, *Bojer in herb. Hook.*—Dipteracanthus monanthos, *N. ab E. in DC. l. c.* p. 125.

*Hab.* In regione centrali insulæ Madagascar, *Bojer*! *et Bouton*! *in herb. Hook.*

5. R. Currori, *T. Anders.* Suffruticosa; caule erecto, tomento minuto dense incano; foliis ovatis, cordatis, integris, pubescentibus; pedicellis axillaribus, solitariis, unifloris; calycis laciniis corollæ tubo dimidio brevioribus, glanduloso-pubescentibus, linearibus, acutis; corolla magna, tubo elongato, limbo infundibuliformi, lobis brevibus, æqualibus, rotundatis.

*Hab.* In Benguela, prope Elephants' Bay, *Curror*! n. 17 *in herb. Hook.*

*Pedicelli* 1 unc. longi. *Bracteæ* nullæ vel cito deciduæ. *Calyx* $\frac{1}{2}$–$\frac{3}{4}$ unc. longus. *Corolla* 3 unc. longa, extus subpubescens, cærulea?

6. R. Thunbergiæflora, *T. Anders.* Caule adscendente, inferne lignoso, tereti, supra nodos constricto, cortice cinereo, ruguloso, papillis asperis obtecto, superne herbaceo, 4-angulari, sulcato; foliis

valde petiolatis, ovato-lanceolatis, utrinque acutis, crenulato-serratis, paucinerviis, glabriusculis; floribus terminalibus, spicatis, spicis abbreviatis, paucifloris, bracteatis; calycis laciniis subæqualibus, lanceolatis, acutis, glabris; corollæ tubo calycem æquante, fauce inflato, incurvo, limbo amplo, lobis æqualibus, rotundatis, integris; ovarii loculis 14-spermis.

*Hab.* In insula Fernando Po, ad altitudinem 1300 ped., *Mann* ! *in herb. Hook.*

*Suffrutex* 2–3-pedalis, erectus. *Folia* 3–4 unc. longa, 1–2 unc. lata; petiolus 1½ unc. longus, teres, subglaber. *Corolla* violacea, 2 unc. longa; limbus 2 unc. latus.

7. R. PILOSA, *Linn. Suppl.* p. 290.—Fabria rigida, *E. Meyer, in Cat. herb. Drèg.*—F. pilosa, *N. ab E. in DC. l. c.* p. 114, *cum syn.*

*Hab.* In Africa australi, ad Macalisberg, *Burke* ! *in herb. Hook.*

8. R. OVATA, *Thunb. Fl. Capen. ed. Schult.* p. 480.—Fabria cordifolia, *N. ab E., DC. l. c.* p. 114, *cum syn.*

*Hab.* Ad Macalisberg, *Burke* ! *in herb. cit.*

9. R. ZEYHERI, *T. Anders.*—Dipteracanthus Zeyheri, *Sond. in Linnæa*, xx. p. 90.

*Hab.* Prope fluvium " Buffalo-hunt " dictum, in Africa australi, *Zeyher* ! *in herb. Sond.*

10. R. HUTTONII, *T. Anders.* Herbacea, erecta, pilis adpressis omnino strigosa; foliis petiolatis, ovatis, obtusis, integris; floribus axillaribus, sessilibus, solitariis vel geminis; corolla extus tomentosa, intus glabra, calyce dimidio longiore; capsula calyce breviore, glabra.

*Hab.* Ad " Howeson's Point,' in regione orientali Africæ australis, *Hutton* ! *in herb. Coll. Trin. Dublin.*

*Stephanophysum Baikiei*, Bot. Mag. t. 5111, which was raised at Kew from plants said to have been sent from Western Africa, is *Siphonacanthus repens*, N. ab E. in Endl. et Mart. Fl. Bras. fasc. vii. p. 47 (*Stephanophysum repens*, mihi)—a species confined to Brazil. Some mistake must have occurred in recording the source from whence the plant at Kew was procured. It was probably sent from South America by Herbst, from whom a case was received at about the same time as one from Dr. Baikie, of the Niger Expedition.

## X. PETALIDIUM, *N. ab E.*

1. P. LINIFOLIUM, *T. Anders.* Erectum, glabrum, ramis lignosis; foliis sessilibus, linearibus, acutis, uninerviis, glabris; pedicellis axillaribus, solitariis, unifloris; bracteis 2, concavo-ovatis, mucronatis, infra medium connatis, membranaceis, albis, nervis viridibus pulcherrime reticulatis; calycis laciniis lineari-lanceolatis, inæqualibus, extus glandu-

losis; corolla infundibuliformi, extus puberula, tubo brevi, limbo inæqualiter 5-lobo, lobo inferiore transversim corrugato.

*Hab.* In Damara Land, regione Africæ australis, *in herb. Coll. Trin. Dubl.* !

*Suffrutex* subvirgatus, glaber, bracteis pulcherrimis conspicuus. Folia 1–2 unc. longa, angustissima, coriacea. *Bracteæ* 1 unc. longæ, glabræ, corollæ tubum valvatim tegentes, persistentes. *Corolla* 1¾ unc. longa, recta; lobis patentibus; lobo inferiore corrugato, pilis reflexis sparse obtecto. *Ovarium* 4-ovulatum. *Capsulam* non vidi.

## XI. PSEUDOBARLERIA, *T. Anders.*

*Bracteæ* 2, oppositæ, magnæ, calycem, corollam in æstivatione et capsulam tegentes. *Calyx* 4-partitus; lacinia superiore et inferiore majoribus; lateralibus minoribus, subulatis. *Corolla* infundibuliformis; tubo constricto, limbo longiore; limbo æqualiter 5-fido, lobis æqualibus, brevibus, æstivatione contortis. *Stamina* 4, inclusa; filamentis æqualibus, fauci insertis, per paria basi connatis; antheris bilocularibus, ovatis, sagittatis, basi breviter mucronatis. *Stylus* teres; stigmate subulato, basi breviter bilobato, paulo revoluto. *Capsula* ovata, acuta, a dorso compresso, verticaliter dehiscente, tetrasperma vel abortu disperma. *Semina* ovata, compressa, tomentosa, margine hyalina, in aqua mucilaginem emittentia.

1. P. HIRSUTA, *T. Anders.* Caule erecto, tetragono, hirsuto; foliis petiolatis, late ovatis, acutis, integris, hirsutis; floribus in cymis lateralibus paucifloris; bracteis ovatis, acutis, integris, pilosis; capsula compressa, glabra, fulva.

*Hab.* Ad oras occidentales Africæ australis extratropicæ, *Curror* ! *in herb. Hook.*

*Suffrutex*? ramosus, pilis patentibus hirsutus. *Caulis* incrassatus. *Folia* cum petiolo 2½–3½ unc. longa, 1–1½ unc. lata. *Flores* in cymis 2-3 unc. longis cum foliis bractiformibus intermixti. *Bracteæ* 1 unc. longæ, pilosæ.

## XII. PHAYLOPSIS, *Willd.*

1. P. PARVIFLORA, *Willd. Sp. Pl.* iii. p. 342.—Ætheilema reniforme, *N. ab E. in Wall. Pl. As. rar.* iii. p. 94, *et in DC. Prod.* xi. p. 261, *cum syn.*—Æ. imbricatum, *N. ab E. in herb. Hook.* partim.

*Hab.* In insula Madagascar, prope Boinatar Bay!; in Pemba insula juxta Zanzibar!; Senegambia, *in herb. Hook.* !

*Distr.* In India orientali! Ceylania!

2. P. LONGIFOLIA, *Sims, Bot. Mag.* t. 2433.—Ætheilema imbricatum, *R. Br. Prod.* p. 478.—Æ. anisophyllum, *Meyer, Cat. Pl. Drèg.*—Barleria inæqualis, *Hochst. in Schimp. Pl. Abyss.* n. 367.—Ruellia imbricata, *Forsk. Descr.* p. 113.

*Hab.* In insula Madagascar, *Bouton*! *Bojer*!; Abyssinia, prope "Dochlii," atque in monte "Scholoda," *Schimper*, nn. 367! et 505!; Africa australi, ad Port Natal, *Krauss*! *Sutherland*!

3. P. Barteri, *T. Anders.* Caule erecto, tetragono, pilis reflexis subscabro; foliis petiolatis, lanceolato-ovatis, basi attenuatis, æqualibus, supra papillis minutis crystallinis scabris, subtus glaucis, nerviis pilis adpressis asperis; floribus in spicis terminalibus vel axillaribus subsecundis; bracteis lanceolato-ovatis vel ovato-rotundatis, erectis, membranaceis; calycis laciniis inferioribus supra medium connatis, lateralibus 2, brevioribus, profunde divisis, superiore spathulata, ovata, acuta, omnibus enerviis, glanduloso-hirsutis.

*Hab.* Ad Onitohe et Nupe, prope fluvium Quorra, *Barter*! *in herb. Hook.*

*Herba* erecta. *Folia* 2–4½ unc. longa, 1–2 unc. lata, aspera; petiolo 1½ unc. longo. *Spicæ* 1–3 unc. longæ. *Corolla* ½ unc. longa. *Ovarium* apice hirsutum. *Capsula* ignota.

## XIII. Whitfieldia, *Hook.*

1. W. lateritia, *Hook. Bot. Mag.* t. 4155.

*Hab.* In Sierra Leone, *Whitfield in herb. Hook., et v. v. cult.*

2. W. longifolia, *T. Anders.*—Ruellia longifolia, *Pal. de Beauv. Fl. Owar. et Ben.* i. p. 45, t. 26.—Dipteracanthus elongatus, *N. ab E. in DC. Prod.* xi. p. 140.

*Hab.* In regione Owariensi, ad grad. latit. 5° aust.; in insula Fernando Po, *Vogel*! *Barter*! et *Mann*! *in herb. Hook.*

## XIV. Barleria, *Linn.*

1. B. bispinosa, *Vahl. Symb.* i. p. 46.—B. Hystrix β. oblongifolia, *N. ab E. in DC. Prod.* xi. p. 239.

*Hab.* In Abyssinia, prope Adoam, *Schimper*, n. 208!

Distr. In Arabia felici!

The East Indian species which Nees von Esenbeck considered identical with Vahl's *Barleria bispinosa* is quite distinct from the Abyssinian specimens, which are certainly Vahl's plant. The East Indian species has greater affinities with *B. buxifolia*, Linn., than with *B. bispinosa*, Vahl. As I consider the East Indian and Ceylon plants, named by Nees von Esenbeck *B. bispinosa* and *B. spina Ceylanica*, to be one species, I propose to adopt the latter specific name, while I retain *B. bispinosa*, Vahl, for the Abyssinian and Arabian plant.

2. B. acanthoides, *Vahl. Symb.* i. p. 47.—B. triacantha, *Hochst. in Schimp. Pl. Abyss.* n. 1004.—B. candida, *N. ab E. in DC. l. c.* p. 240.—B. eranthemoides, *R. Br.*

*Hab.* In Abyssinia, prope Adegannam et fluvium Tacaz, *Schimp.* nn. 1004! et 1856!; Nubia et regno Kordofan, *Kotschy*!

*Distr.* In Arabia felici! Muscat! Scinde!

3. B. PRIONITIS, *Linn. Sp. Pl.* 887.—B. Hystrix, *Linn. Mant.* p. 89. —B. diacantha, *Hochst. in Schimp. Pl. Abyss.* n. 1008 et 1922.—B. hypocrateriformis, *Hochst. l. c.* n. 2194.—B. brevispina, *R. Br. in Salt. Abyss. App.*
*Hab.* In Abyssinia, prope Adegannam atque in montibus prope Dochadsa, ad altitudinem 5000 ped.; in insula Mauritio vix spontanea, sed ab India orientali introducta.

4. B. STIMULANS, *E. Mey. in Cat. Pl. Drèg.*; *N. ab E. in DC. l. c.* p. 241.
*Hab.* In Africa australi, ad fluvium "Gamka," *Burke*! *in herb. Hook.*; *Drège*! *in herb. Sond.*

5. B. IRRITANS, *N. ab E. DC. l. c.* p. 236.—B. pungens, *Thunb. Fl. Cap., ed. Schult.* p. 458.
*Hab.* In Africa australi, ad Uitenhage, *Drège*! *Zeyher*!

6. B. ILICINA, *E. Mey. MSS.* (absque descriptione). Erecta, glabra, caule tereti; foliis breviter petiolatis, ovatis, apice spinosis, margine spinoso-dentatis; bracteis simplicibus, rigidis, apice et margine spinosis; calycis laciniis exterioribus ovatis, margine longe spinoso-dentatis, membranaceis, glabris, reticulatis, interioribus lanceolatis, spinosis, uninerviis. Corollam et capsulam non vidi.
*Hab.* In locis rupestribus ad fluvium Garip in Africa australi, *Drège*! *in herb. Sond.*

7. B. PUNGENS, *Linn. Suppl.* p. 290, et *N. ab E. DC. l. c.* p. 236.—Crabbea pungens, *Harv. Gen. South-Afric. Pl.* 276.
*Hab.* In Africa australi, ad Uitenhage, *Drège*! *in herb. Sond.*; Caffraria, *Brownlee*!; Grahamstown, *Bolton*!; Albany, *Williams*!

8. B. MEYERIANA, *N. ab E., DC. l. c.* p. 230, *cum syn.*
*Hab.* Ad Port Natal in Africa australi, *Drège*! *Gueinzius*! *in herb. Hook.*

9. B. LANCIFOLIA, *T. Anders.* Erecta, pruinosa; foliis lineari-lanceolatis, acutis, integerrimis, mucronulatis; floribus sessilibus, axillaribus, solitariis; bracteis herbaceis, erectis, linearibus, calyce dimidio brevioribus; calycis laciniis herbaceis, integris, glandulosis, exterioribus ovatis vel ovato-lanceolatis, acutis, interioribus brevioribus, lanceolatis corolla infundibuliformi, tubo brevissimo, fauce dilatata, lobis late ovato-rotundatis; staminibus fertilibus 2, inclusis, filamentis basi connatis, anantheris 3 brevissimis; ovulis 4; capsula rostrata, glanduloso-tomentosa.
*Hab.* In Damara Land, regione Africæ austro-occidentalis, *in herb. Coll. Trin. Dubl.*
*Suffrutex* parvus. *Caulis* teres, cortice cinereo, pruinoso. *Folia* 1–2 unc. longa, juniora puberulo-glandulosa. *Bracteæ* 3 lin. longæ, angustissime lineares. *Calycis* laciniæ exteriores 3–6 lin. longæ. *Corolla* 1½ unc. longa, pulchra, limbo amplo, lobis patentibus.

10. B. DAMARENSIS, *T. Anders.* Erecta, pubescens; foliis petiolatis, ovatis, acutis, mucronatis, integris, puberulis; bracteis late subulatis, mucronatis; calycis laciniis lanceolatis, mucronulatis, integris, puberulis; exterioribus 5–7-nerviis; interioribus paulo brevioribus, glandulosis, uninerviis; corolla subhypocraterimorpha, extus puberula, tubo æquali, calyce duplo longiore, lobis ovatis patentibus; staminibus fertilibus 2, exsertis, sterilibus 2, alteris multo brevioribus.

*Hab.* In Damara Land, *herb. Coll. Trin. Dubl.*

The character of the outer segments of the calyx, the form of the corolla (especially of the tube) and the exserted stamens, sufficiently distinguish this species from its allies *B. Meyeriana* and *lancifolia.*

11. B. HOCHSTETTERI, *N. ab E. in DC. l. c.* p. 231.—B. Aucheriana, *N. ab E. l. c.* p. 234.

*Hab.* In Nubia et regno Kordofan, *Kotschy*, n. 119!

*Distr.* In Arabia felici! Muscat! Scinde!

12. B. PARVIFLORA, *R. Br. in Salt. Abyss. Append.* (absque descriptione). Caule erecto, ramis teretibus, divaricatis, junioribus pilis adpressis incano tomentosis; foliis obtuse lanceolatis vel ovatis, basi cordatis, mucronulatis, integerrimis, glaucis; floribus axillaribus, pedicellatis, solitariis vel geminis; bracteis ovatis, acutis, concavis, carinatis, integris, herbaceis, uninerviis; calycis laciniis herbaceis, carinatis, exterioribus bracteis brevioribus, ovato-lanceolatis, acutis; interioribus subulatis, exterioribus brevioribus; corolla campanulato-infundibuliformi, glabra, limbi lobis obovato-rotundatis; staminibus fertilibus 2, inclusis, anantheris 3; capsula rostrata, disperma, fusca, glabra; seminibus tomentosis.—*B. cordifolia,* Hochst. in Schimp. Pl. Abyss.

*Hab.* In montibus prope Tazeroo, oppidum Abyssiniæ, ad altitudinem 3500 ped., *Schimp.* n. 2291!

*Suffrutex* erectus, 1–2-pedalis. *Rami* divaricati; vetustiores lignosi, cortice fusco vel glauco; juniores incano-tomentosi. *Folia* ¼–1½ unc. longa, 3 lin.–¾ unc. lata. *Calyx* 3 lin. longus. *Corolla* ½ unc. longa.

13. B. ORBICULARIS, *Hochst. l. c.* (absque descriptione). Erecta, ramosa; foliis petiolatis, ovatis, integerrimis, pilis strigosis pubescentibus; floribus pedicellatis, axillaribus, solitariis vel in cymulis axillaribus paucifloris confertis; bracteis parvis, herbaceis, obovato-spathulatis, integris; calycis laciniis exterioribus magnis, late rotundo-cordatis, subherbaceis, superiore apice breviter bimucronulata, inferiore integra, interioribus brevissimis, subulatis; corolla subinfundibuliformi, limbo breviter 5-lobo; staminibus fertilibus 2, inclusis; capsula rostrata, disperma, tomentosa.

*Hab.* Abyssinia, in montibus prope Tazeroo, ad altitudinem 3300 ped., *Schimper*, n. 2189!

*Suffrutex* 1–2-pedalis. *Rami* divaricati, teretes, pubescentes. *Folia* cum petiolo 1–2 unc. longa, ¾ unc. lata, herbacea. *Cymulæ* 3–5-floræ, axillares. *Bracteæ* ½ unc. longæ. *Calycis* laciniæ exteriores 10 lin. longæ, 9 lin. latæ, virides, interiores 2 lin. longæ. *Corolla* parva, inconspicua, calyce plus minus occulta. *Capsula* 5 lin. longa, fulva, tomentosa. *Semina* ovata, compressa; testa carnosa.

14. B. VENTRICOSA, *Hochst. l. c.* et *N. ab E. in DC. l. c.* p. 230.
*Hab.* In dumetis partis inferioris "Scholoda" montis Abyssinici, *Schimper*, nn. 42! 1903!

15. B. GRANDIFOLIA, *R. Br. Salt. Abyss. Append.*—B. grandis, *Hochst.* et *N. ab E.*, *DC. l. c.* p. 233.
*Hab.* In monte Sinai, prope Adoam oppidum Abyssinicum, *Schimper*, n. 702!

16. B. KIRKII, *T. Anders.* Tomentosa; caule obsolete tetragono; foliis ovatis, lanceolatis, acutis, integerrimis, pilosis; floribus in cymulis brevissimis axillaribus, vel subsessilibus solitariis; calyce reticulato-membranaceo, pubescente, laciniis exterioribus oblongis, apice mucronatis, margine acute dentatis subspinosis, interioribus minoribus subulato-lanceolatis; capsula subovata, brevissime rostrata, nigra, nitida. Corollam non vidi.
*Hab.* Ad Kaurabassa, prope Tette, in Africa austro-orientali tropica, *Kirk*!
*Planta* subherbacea, pilis floccosis omnino tomentosa. *Folia* ½–1 unc. longa, ½ unc. lata, pilis floccosis et simplicibus utrinque obtecta. *Cymulæ* 3–4-floræ. *Flores* approximatæ. *Bracteæ* calyce breviores, rigidæ, acute spinosæ, superne canaliculatæ, tomentosæ. *Calycis* laciniæ exteriores 8 lin. longæ, varie 5–7-spinosodentatæ.

17. B. GUEINZII, *Sond. in Linn.* xxiii. p. 91.
*Hab.* In Africa australi, ad Natal, *Gueinzius*! *in herb. Sonder.*, *Sutherland*! *in herb. Hook.*

18. B. RUELLIOIDES, *T. Anders.* Inermis; caule subtetragono; foliis breviter petiolatis, ovatis, utrinque attenuatis, integris, superne glabris, subtus glaucis; bracteis minutis, herbaceis, subulatis; calycis laciniis exterioribus magnis, late ovatis, acutis, integris, pubescentibus, interioribus minutis subulatis; corolla infundibuliformi; capsula obovata, erostrata, mucronata, chartacea, glabra, fulva; seminibus 2, magnis, ovatis, fulvo-sericeis.
*Hab.* Nupe ad ripas fluminis "Quorra," *Barter*!
*Subherbacea*, 3-pedalis, erecta, pauce ramosa, partibus junioribus pilis strigosis pubescentibus. *Caulis* ad angulos pilis adpressis sparse obtectus. *Folia* 2–4 unc. longa, 8 lin.–1¾ unc. lata, herbacea, paucinervia, ad nervos utrinque subaspera; petiolo 3–4 lin. longa. *Calycis* laciniæ exteriores 8 lin. longæ, 5 lin. latæ, ciliatæ. *Corolla* 1½ unc. longa, glabra, cærulea; lobis æqualibus. *Capsula* 5 lin. longa, 3 lin. lata, calyce occulta.

19. B. BOIVINII, *T. Anders.* Erecta, ramosa; caule tetragono, sulcato, cortice glauco; foliis petiolatis, lanceolato-ovatis, acuminatis, integris, glabris; cymis terminalibus, paucifloris, abbreviatis; bracteis herbaceis, linearibus, acutis, calyce brevioribus; calyce subherbaceo, laciniis exterioribus oblongis obtusis, interioribus brevioribus, lineari-lanceolatis, tomentosis, margine ciliatis; corolla anguste infundibuliformi, profunde 5-lobata, extus pubescente, intus glabra; staminibus fertilibus 2, inclusis, sterilibus 3; capsula obovata, erostrata, mucronata, glabra, fusco-nigrescente, disperma.

*Hab.* In insula Madagascar, *Boivin* !

*Suffrutex* erectus, inermis, glaber, cortice glauco. *Folia* 2–3½ unc. longa, 1–½ lata, herbacea, glabra, subtus ad nervos pilis adpressis tomentosa. *Calyx* 5–6 lin. longus, 2–3 lin. latus, lacinia inferiore apice paulo bidentata. *Corolla* 2 lin. longa, cærulea; tubo elongato. *Stamina* sterilia brevissima.

20. B. REPENS, *N. ab E. in DC. l. c.* p. 230.

*Hab.* In insula Pemba, in locis humidis, *Bojer* ?; in insula Raza, ad oras Africæ orientalis, *Forbes* ! *in herb. Hook.*

21. B. OBTUSA, *N. ab. E. in Linn.* xv. p. 358, *et in DC. l. c.* p. 231.—B. diandra, *Schlechtend. in herb. Drèg.*—B. barbata, *E. Mey. in Pl. Drèg.*

*Hab.* Ad Uitenhage, *Drège* ! *Harvey* !; Port Natal, *Grant* ! *Burke* ! *Plant* ! *Sutherland* ! *Sanderson* !

22. B. OPACA, *N. ab E. in DC. l. c.* p. 230.

*Hab.* Ad Accra, in oris Africæ occidentalis tropicæ, *Don* !

23. B. BURKEANA, *Sond. in Linn.* xxiii. p. 92.—B. Burchelliana *et* macrostegia, *N. ab E. in DC. l. c.* p. 235.

*Hab.* Prope flumen "Vet River" in Africa australi, *Burke* ! *in herb. Hook.*

24. B. OVATA, *Meyer, Cat. Pl. Drèg.*, *N. ab E. l. c.* p. 230.

*Hab.* In territorio Cap. Bon. Spei, *Drège* ! *in herb. Hook.*

25. B. PAPILLOSA, *T. Anders.* Erecta, spinosa; caule subtereti, glauco; foliis subsessilibus, ovatis, spinoso-dentatis, coriaceis, papillosis; floribus axillaribus solitariis atque in spicis terminalibus confertis; bracteis linearibus, spinosis, acutis, margine spinosis; calycis laciniis exterioribus magnis, ovatis, apice spinoso-mucronatis, margine spinoso-dentatis, reticulato-nervosis, glanduloso-pubescentibus, interioribus lineari-lanceolatis, mucronatis, uninerviis, exterioribus brevioribus; corolla subhypocraterimorpha, lobis obovatis, apice rotundatis; staminibus fertilibus 2, exsertis.

*Hab.* In Namaqualand, regione Africæ australis, *Wyley* ! *in herb. Harvey.*

*Suffrutex* erectus. *Caulis* divaricatus, nodis approximatis. *Folia* 3 lin. longa, 1–2 lin. lata, crassa, coriacea, papillis obtusis utrinque obtecta.

*Spicæ* 2–3 unc. longæ. *Bracteæ* rigidæ et acute spinosæ, superne canaliculatæ, vetustiores albescentes. *Calycis* laciniæ exteriores 6 lin. longæ, 4–5 lin. latæ. *Corolla* 1 lin. longa, extus puberula, purpurea.

26. B. FLAVA, *Jacq. Eclog.* p. 67. t. 46; *N. ab E. l. c.* p. 224.—B. Senegalensis, *N. ab E. l. c.*

*Hab.* In Senegambia, ad ripas fluvii Rio Nunoz, *Heudelot*!, n. 644 *in herb. Hook.*

For many years this species has been a favourite plant in our stoves, to which it was introduced from the Jardin des Plantes at Paris. It was always considered an Arabian plant,—an error which originated with Jacquin. Nees von Esenbeck, though he detected Jacquin's mistake, added to the confusion by quoting Equatorial America as the native country of *B. flava.* At the same time, he remarks that his *B. Senegalensis* is perhaps the origin of the cultivated plant. In this he is certainly correct; for, after a careful comparison of Heudelot's Senegal specimens with living and dried ones of the garden plant, I can find no difference between them. I have therefore united the two species, and adopted Jacquin's very appropriate specific name.

27. B. LUPULINA, *Lindl. Bot. Reg.* t. 1483, *N. ab E. l. c.* p. 237.—B. macrostachya, *Boj. Hort. Maurit.* p. 260.

*Hab.* In locis aridis in insula Madagascar, *Bojer*! *in herb. Hook.*

28. B. HALAMOIDES, *N. ab E. l. c.* p. 231.

*Hab.* In oris Africæ austro-occidentalis extratropicæ, *Curror*! *in herb. Hook.*

29. B. ACANTHOPHORA, *N. ab E. l. c.* p. 726.

*Hab.* Ad Mozambique, *Loureiro.*

## XV. CRABBEA, *Harv.*

1. C. NANA, *N. ab E. in DC. Prod.* xi. p. 162, *cum syn.*—C. cirsoides, *N. ab E. l. c.* p. 163, *cum syn.*

*Hab.* In Africa australi ad "Seven Fountains," prope fluvium "Vaal," *Burke*! *in herb. Hook.*; *Drège*! *et Ecklon et Zeyher*!

2. C. HIRSUTA, *Harv. in Lond. Journ. of Bot.* i. p. 27; *N. ab E. l. c.*

*Hab.* Ad Port Natal in Africa australi, *in herb. Trin. Coll. Dubl.*

3. C. ANGUSTIFOLIA, *N. ab E. l. c.*

*Hab.* Ad Macalisberg in Africa australi, *Burke*! *in herb. Hook.*

## XVI. LANKESTERIA, *Lindl.*

1. L. HISPIDA, *T. Anders.*—Eranthemum hispidum, *N. ab E. in DC. Prod.* xi. p. 456, *cum syn.*—Lankesteria parviflora *et* L. longiflora, *Lindl. Bot. Reg.* xxxii. t. 12.

*Hab.* In Sierra Leone, *Don*!, *Barter*! *in herb. Hook.*

2. L. ELEGANS, *T. Anders.*—Eranthemum elegans, *R. Br.*, *N. ab E. l. c.* p. 447, *cum syn.*
*Hab.* In sylvis prope Abeokuta, *Barter* ! *in herb. Hook.*

### XVII. CROSSANDRA, *Salisb.*

1. C. GUINEENSIS, *N. ab E.*, *DC. Prod.* xi. p. 281.
*Hab.* In oris Guineæ, *in herb. Hook.* !; in insula Fernando Po, *Mann* !

2. C. MADAGASCARIENSIS, *T. Anders.*—Polythrix Stenandrium, *N. ab E. l. c.* p. 286.
*Hab.* In montibus provinciæ Emiræ et in sylvis loci "Be' fourem" dicti insulæ Madagascar, *Bojer* ! *in herb. Hook.*

3. C. FLAVA, *Hook. Bot. Mag.* t. 4710.
*Hab.* In insula Fernando Po in monte "Sugar-loaf" dicto, *Whitfield. V. cult.*

### XVIII. LEPIDAGATHIS, *Willd.*

1. L. RADICALIS, *Hochst. in Schimp. Pl. Abyss.*; *N. ab E.*, *DC. Prod.* xi. p. 255.
*Hab.* In Abyssinia locis siccis calidis apricis prope Axum, n. 1525 ! et in rupibus schistosis prope Adoam, n. 1072, *Schimper* !

2. L. ANOBRYA, *N. ab E. l. c.*
*Hab.* In Senegambia, *Heudelot in herb. Hook.* n. 204 !

3. L. HEUDELOTIANA, *N. ab E. l. c.* p. 254.
*Hab.* In Senegambia, ad fluvium Rio Nunoz, *Heudelot in herb. Hook.* n. 666 !

4. L. MOLLIS, *T. Anders.* Erecta; caule tetragono, aspero; foliis sessilibus, lineari-lanceolatis, mucronulatis, superne scabris, subtus tomentosis, trinerviis; floribus in spicis radicalibus et caulinibus confertis; bracteis lanceolatis, acutis, breviter aristatis, membranaceis, tomentosis, ciliatis; calycis laciniis membranaceis, uninerviis, tomentosis, ciliatis, majoribus 2 lanceolatis, minoribus 3 linearibus; corolla bilabiata fauce setis deflexis clausa; staminibus 4, inclusis; filamentis æqualibus.
*Hab.* In collibus saxosis ad Nupe prope fluvium Quorra, *Barter* ! *in herb. Hook.*
*Suffruticulus* basi lignosus. *Caules* a radice 2–3 vel plurimi, adscendentes, pedales. *Folia* 2–3½ unc. longa, 3 lin. lata, rigida. *Spicæ* ovatæ vel subglobosæ, fulvæ, pilis albo-sericeis tomentosæ; radicales plures, dense confertæ; caulinæ pauciores, laterales, non verticillatæ. *Corolla* ¾ unc. longa, flava, intus maculis fulvis notata.

5. L. TERMINALIS, *Hochst. in Schimp. Pl. Abyss.*; *N. ab E. l. c.* p. 251.
*Hab.* Ad rupes in locis siccis infra Sessaquilla in Abyssinia, *Schimper*, n. 815 ! et 1920 ! *in herb. Hook.*; e regno Fayzokl, *Kotschy*, n. 482 !

6. L. CALYCINA, *Hochst. l. c.*; *N. ab E. l. c.* p. 252.
*Hab.* In Abyssinia, prope Tazeroo, alt. 3500 ped., *Schimper*, n. 2190!
*Distr.* In Scinde!

7. L. GLANDULOSA, *N. ab E. l. c.* p. 243.—Barleria glandulosa, *Hochst. in Schimp. Pl. Abyss.*
*Hab.* In Abyssinia ad montem Scholoda, *Schimper*, n. 44!

8. L. HYSSOPIFOLIA, *T. Anders.*—Teliostachya hyssopifolia, *Benth. in Fl. Nigrit.* p. 481.
*Hab.* Sierra Leone, *Don*!

9. L. LAGUROIDEA, *T. Anders.*—Teliostachya laguroidea, *N. ab E. l. c.* p. 264.
*Hab.* Accra in oris Africæ orientalis ad lat. bor. 5°, *Vogel*!; ad ripas fluvii "Oty" tributarii Quorra, *Barter*!

I have seen a species of *Lepidagathis* in the Kew Herbarium among a collection of plants made in Congo by Christian Smith. It is closely allied to the Asiatic species *L. fasciculata*, but the specimen is too imperfect for specific determination.

## XIX. BLEPHARIS, *Juss.*

1. B. BOERHAAVIÆFOLIA, *Juss.*; *N. ab E.*, *DC. Prod.* xi. p. 266, *cum syn.*
*Hab.* In Congo, *C. Smith*! in Senegambia, *Heudelot*! Abyssinia in monte Scholoda et montanis prope Axum, *Schimper*, nn. 247! 1492! 1895!; in Guinea, *Thonning*! *in herb. Sonder.*
*Distr.* India orientali, Ceylania et Java.

2. B. GUEINZII, *T. Anders.*—B. boerhaaviæfolia, var. micrantha, *Sond. in Linn.* xxiii. p. 92.
*Hab.* Ad Port Natal in Africa australi, *Gueinzius*! *in herb. Sonder.*

3. B. SATURIÆFOLIA, *Pers. Syn.* ii. p. 180; *N. ab E. l. c.* p. 265, *cum syn.*
*Hab.* In Africa australi extratropica ad fluvium "Vat" et Grahamstown, *Burke*!; ad Port Natal, *Krauss*!, *Drège*! *in herb. Hook. et Sond.*; ad fluvia "Aapges" et "Vat."

4. B. PUNGENS, *Klotzsch in Peters, Mossamb. Bot.* p. 211. Caule ramoso, tereti; foliis sessilibus, lineari-lanceolatis, apice acutissime acicularibus, margine spinoso-serratis, uninerviis, utrinque glanduloso-puberulis; floribus axillaribus, solitariis, sessilibus; bracteis lanceolatis, acutis, apice spinoso-serratis, 3-nerviis, pubescentibus; calycis laciniis pubescentibus, superiore inferiore paulo longiore.
*Hab.* In Africa orientali tropica ad fluvium Zambesi, *Kirk*!
*Suffruticulus* elegans, vix pedalis, ad basin lignosus. *Caulis* cortice cinereo, pubescente. *Calyx* profunde 4-partitus, lacinia superiore integra, 3-nervia; inferiore bidentata, 2-nervia; lateralibus subulatis,

integris, uninerviis. *Corolla* tubo brevi, limbo unilabiato, labio trifido, linea media callosa 3-nervia. *Stamina* 4, subæqualia. *Ovarium* biovulatum. *Capsula* glabra, subchartacea. *Semina* testa muricata.

5. B. ANGUSTA, *T. Anders.*—Acanthodium angustum, *N. ab E. l. c.* p. 273.
*Hab.* In Africa australi prope "Schoon strom," *Burke*! *in herb. Hook.*; ad "Nonderfontzs," *Zeyher*!; Natal, *Owen*! *in herb. Trin. Coll. Dubl.*

6. B. PROCUMBENS, *Pers. Synops.* ii. p. 180.—Acanthodium procumbens, *N. ab E. l. c.* p. 273, *cum syn.*—A. diversispinum, *N. ab E. l. c.* p. 275.
*Hab.* In Africa australi prope Uitenhage et in collibus juxta fluvium Zwartkop, *Drège*!, *Ecklon et Zeyher*!

7. B. FURCATA, *T. Anders.*—Acanthodium furcatum, *N. ab E. l. c.* p. 276, *cum syn.*—A. macrum, *N. ab E. l. c.*
*Hab.* In Africa australi ad Port Natal, *Sutherland*!; ad fluvium "Gamka," *Burke*! Namaqualand, *Wyley*!; ad Springbok Kral, *Zeyher*! *Drège et Ecklon in herb. Sonder*!

8. B. CAPENSIS, *Pers. Syn.* ii. p. 180.—Acanthodium Capense, *N. ab E. in Linn.* xv. p. 361, *et DC. l. c.* p. 276, *excl. var. β. et δ.*—Acanthus Capensis, *Linn.*, *Thunb. Fl. Cap.* ii. p. 455.
*Hab.* Per Africam australem extratropicam vulgatissima, *Drège*!, *Ecklon et Zeyher*!, *Sanderson*! *in herb. Hook.*, *Trin. Coll. Dubl. et Sonder.*

9. B. HIRTINERVIA, *T. Anders.*—Acanthodium hirtinervium, *N. ab E. l. c.* p. 277.—A. Capense, var. *β.* et *δ.* villosum, *N. ab E.*, *DC. l. c.* p. 276.
*Hab.* Ad Uitenhage, *Drège*!; ad Fish River, *Burke*!; Somerset, *Bowker*! *in herb. Hook.*

10. B. SQUARROSA, *T. Anders.*—Acanthodium squarrosum, *N. ab E. in DC. l. c.* p. 275.
*Hab.* In Africa australi ad fluvium "Kat" dictum, *Burke*! *in herb. Hook.*; ad Grahamstown, *Bolton*!

11. B. CARDUIFOLIA, *T. Anders.*—Acanthodium carduifolium, *N. ab E. l. c.* p. 278, *cum syn.*—A. Hoffmannseggianum, *N. ab E. l. c.* p. 277.
Var. glabra, *T. Anders.*—Acanthodium glabrum, *N. ab E. l. c.* p. 278, *cum syn.*
*Hab.* In Africa australi ad Cannisberg; Namaqualand, *Drège*! *in herb. Hook. et Sonder.*

12. B. SPATHULARIS, *T. Anders.*—Acanthodium spathulare, *N. ab E. l. c.* p. 277, *cum syn.*
*Hab.* In Namaqualand, *Drège*! *in herb. Sonder.*

I have seen only a very imperfect specimen of this species.

13. B. GLAUCA, *T. Anders.*—Acanthodium glaucum, *N. ab E. l. c.* p. 277.
*Hab.* In montibus Namaqualand inter "Elephant River et Kaus," ad lat. 22° aust., *Drège!*

Both this and the preceding species very much resemble *B. carduifolia.*

14. B. GROSSA, *T. Anders.*—Acanthodium grossum, *N. ab E. l. c.* p. 274.
*Hab.* In oris Africæ austro-occidentalis versus tropicam, *Curror! in herb. Hook.*

15. B. LINARIÆFOLIA, *Pers. Synops.* ii. p. 180.—Acanthodium hirtum, *Hochst. in Kotsch. Pl. Nub.* n. 256; *N. ab E. l. c.* p. 274.
*Hab.* In Senegambia, *Heudelot,* n. 179! *in herb. Hook.*; prope Nupe ad ripas fluvii Quorra, *Barter!*

There is a *Blepharis* found in Scinde and the Punjab which is figured by Wight in the 'Icones,' t. 1535 & 1536, as *Acanthodium grossum,* N. ab E., while the specimens of it in the Kew Herbarium are referred by Planchon to *Acanthodium hirtum,* Hochst. The Scinde plant is quite distinct from both of these species, though it is nearly allied to the last one. In an Enumeration of East Indian Acanthaceæ which I am preparing in uniformity with Hooker and Thomson's Præcursores, I have adopted Stock's MS. name for this species, *B. Scindica.*

16. B. EDULIS, *Pers. Synops.* ii. p. 180.—Acanthodium spicatum, *Delil., N. ab E. l. c.* p. 274, *cum syn.*—Acanthus tetragonus, *R. Br. in Salt. Abyss. Append.*
*Hab.* In Abyssinia, in convalle Dallub, *Roth!*; Nubia, *Kotschy,* n. 33!; Ægypto in deserto inter Suez et Cairo, *Madden!*
*Distr.* In Arabia petræa! et felici! Muscat! Beloochistan!

## XX. ACANTHOPSIS, *Harv.*

1. A. HORRIDA, *N. ab E., DC. Prod.* xi. p. 278, *cum syn.*
*Hab.* In Africa australi, *Drège! in herb. Hook. et Trin. Coll. Dubl.*; *Ecklon et Zeyher! in herb. Sonder.*

2. A. DISPERMA, *Harvey in Hook. Journ. Bot.* i. p. 28; *N. ab E., DC. l. c. cum syn.*
*Hab.* In Africa australi ad fluvium "Garip" in regione "Little Namaqualand" dicta, *Drège! in herb. Hook. et Sonder.*

## XXI. ACANTHUS, *Linn.*

1. A. ILICIFOLIUS, *Linn. Sp. Pl.* p. 639.—Dilicaria ilicifolia, *N. ab E., DC. l. c.* p. 268, *cum syn.*
*Hab.* Prope Uitenhage, *Wendemann! in herb. Sonder.*
*Distr.* Per totam Asiam tropicam in locis maritimis.

2. A. KIRKII, *T. Anders.* Caule tereti, glabro; foliis ovatis, acutis, basi in petiolum attenuatis et decurrentibus, integerrimis, glabris; spicis terminalibus, brevibus, bracteatis, bracteis magnis, concavis, late ovatis, obtusis, mucronulatis, nitidis, margine membranaceis; calycis laciniis lanceolatis, acutis, duriusculis, glabris; corollæ labio 5-lobo, lobis rotundatis; filamentis æqualibus, glabris; ovarii loculis biovulatis.

*Hab.* Ad altitudinem 2000 ped. in Moramballa montem Africæ orientalis tropicæ, *Kirk!*

*Frutex* subvolubilis, glaber, inermis. *Folia* herbacea, ovata, utrinque glabra, petiolata, cum petiolo 6–10 unc. longa, 3–4 unc. lata. *Flores* magnæ, glabræ, suaveolentes.

3. A. BARTERI, *T. Anders.* Caule lignoso, tereti; foliis petiolatis, ovatis, acuminatis, mucronatis, margine serrato-dentatis, spinosis, utrinque scabris; spicis terminalibus; bracteis lanceolatis, margine et apice longe spinosis; capsula magna, glabra, valvis subchartaceis.

*Hab.* Ad Onitshe in Africa tropica prope fluvium Quorra, *Barter* !

*Suffrutex* 3-pedalis. *Caulis* glaber. *Folia* cum petiolo 6–9 unc. longa, 3–4 unc. lata, superne scabra, subtus asperrima. *Spicæ* 5 unc. longæ. *Calycem corollam*que non vidi.

4. A. MONTANUS, *T. Anders.*—Cheilopsis montana, *N. ab E. l. c.* p. 272, *syn. exclus.*

*Hab.* In montibus insulæ Fernando Po, *Vogel*! *in herb. Hook.*

5. A. MOLLIS, *Linn. Sp. Pl. ed. Willd.* iii. p. 397; *N. ab E. l. c.* p. 270.

*Hab.* Ad oppidum "Algiers" in Africa boreali, *Jamin*! *in herb. Hook.*

*Distr.* In oris septentrionalibus maris Mediterranei atque in Europa australi.

6. A. ARBOREUS, *Forsk. Descr.* p. 115.—Cheilopsis arborea, *N. ab E. l. c.* p. 272.—C. polystachya, *Moq.-Tand. in Ann. Sc. Nat.* sér. 1. t. xxvii. p. 230; *N. ab E. l. c.* p. 273.

*Hab.* In regno Fayzokl, *Kotschy,* n. 489!; Abyssinia, *Plowden*! *in herb. Hook.*

## XXII. SCLEROCHITON, *Harvey.*

1. S. HARVEYANUS, *N. ab E., DC. l. c.* p. 279.

*Hab.* Ad "Orange River" fluvium Africæ australis, *Burke*! *in herb. Hook.*; *Drège*! *in herb. Hook. et Sonder.*

2. S. VOGELII, *T. Anders.*—Isacanthus Vogelii, *N. ab E. l. c.*

*Hab.* Ad promontorium Palmas Africæ occidentalis, *Vogel*!, *Ansell*! *in herb. Hook.*

## XXIII. DUVERNOIA, *E. Mey.*

1. D. ADHATODOIDES, *E. Mey. Pl. Cat. Drèg.*; *N. ab E., DC. Prod.* xi. p. 323.

*Hab.* In Africa australi in regione promontorii Bonæ Spei, *Drège*! *in herb. Hook. et Sonder.*

## XXIV. JUSTICIA, *Linn.*

Sect. 1. **BETONICA.** *Floribus terminalibus axillaribusve, spicatis; bracteis imbricatis. Frutices vel suffrutices.*

† *Spicis terminalibus.*

1. J. SCHIMPERIANA, *T. Anders.*—Adhatoda Schimperiana, *Hochst. in Schimp. Pl. Abyss.*; *N. ab E.*, *DC. Prod.* xi. p. 388, *cum syn.*
*Hab.* In Abyssinia ad montes prope Axum et in vallibus apricis prope Adoam, *Schimper*, nn. 27! et 1549!

2. J. BETONICA, *Linn.*—A. Betonica, *N. ab E. l. c.* p. 385.—A. variegata, *N. ab E. l. c. cum syn.*—A. lupulina, *N. ab E. l. c. cum syn.*—A. cheiranthifolia, *N. ab E. l. c.* p. 387.
*Hab.* In collibus siccis prope Dochli pagum "Sana" districtus Abyssiniæ, *Schimper*, n. 516!; in Africa australi ad fluvium Aapges et ad Macalisberg, *Burke*!; ad Port Natal, *Williamson*! *in herb. Hook.*

3. J. MACULATA, *T. Anders.* Caule scandente seu volubile; foliis petiolatis, ovatis, apice acutis vel acuminatis, integris, utrinque glabris; spicis in ramis terminalibus, brevibus; bracteis bracteolisque parvis, subulatis; calycis laciniis lanceolatis, bracteis longioribus extus glabriusculis, intus puberulis; corolla intus maculis purpureis dense notata, extus pubescente, tubo brevi, dilatato; staminibus exsertis, antheris loculo inferiore breviter calcarato; ovario styloque tomentosis.
*Hab.* In insula Fernando Po, *Mann*!
*Frutex* 10–15-pedalis, scandens. *Caulis* lignosus, teres, cortice rubescente. *Folia* 3–6 unc. longa, 2–3½ unc. lata, basi obtusa, subtus paucinervia; petiolus 1–2 unc. longus. *Spicæ* 3–4 unc. longæ, sublaxæ, pilis adpressis puberulæ. *Bracteæ* 2–3 lin. longæ. *Corolla* magna, 1 unc. longa, alba, maculis purpureis notata.

†† *Spicis axillaribus, oppositis.*

4. J. TRISTIS, *T. Anders.*—A. tristis, *N. ab E. l. c.* p. 404.
*Hab.* In insula Fernando Po, *Vogel*!, *Mann*!

Sect. 2. **ROSTELLARIA.** *Floribus terminalibus spicatis, vel axillaribus subsolitariis; bracteis ciliatis. Plantæ herbaceæ, plerumque neglectæ.*

† *Floribus terminalibus spicatis.*

5. J. NATALENSIS, *T. Anders.*—A. Natalensis, *N. ab E. l. c.* p. 391.
*Hab.* In Africa australi ad Port Natal, *Krauss*! *in herb. Hook.*, *et Bentham, Sanderson*!, *Sutherland*!

6. J. PALUSTRIS, *T. Anders.*—A. palustris, *N. ab E. l. c.* p. 402, *cum syn.*—A. Kotschyi, *N. ab E. l. c.* p. 397, *cum syn.*
*Hab.* In regno Kordofan, *Kotschy*, n. 61!; Abyssinia, in agris otiosis prope Goelbb, ad altitudinem 4000 ped., *Schimper*, nn. 1211! et 2156!

7. J. MAJOR, *T. Anders.*—A. major, *N. ab E. l. c.* p. 397, *cum syn.*
*Hab.* In Abyssinia ad ripas fluvii Tacaze sub arborum umbra, *Schimper*, n. 1251!

8. J. MINOR, *T. Anders.*—A. minor, *N. ab E. l. c.* p. 400, *cum syn.*
*Hab.* In Abyssinia montibus prope Tazeroo, locis aridis, alt. 4000 ped., *Schimper*, n. 2296!

*J. major* and *J. minor* will probably prove to be states of one species.

9. J. PLICATA, *Vahl, En.* i. p. 157.—A. plicata, *N. ab E. l. c.* p. 401.
*Hab.* In Africa occidentali ad Cape Coast et ad ostium fluvii Quorra, *Vogel*!; in sylvis umbrosis prope Onitshe, *Barter*!; in insula Fernando Po, *Vogel*! *in herb. Hook.*

10. J. KIRKIANA, *T. Anders.* Caule erecto, subscabriusculo, dichotome ramoso, sulcato; foliis subsessilibus, longissime linearibus, acutis, basi attenuatis, integris, utrinque scabriusculis; floribus terminalibus, spicatis; bracteis linearibus, margine ciliatis; calycis laciniis parvis, subulatis, ciliatis; corolla extus puberula, tubo brevi, labio inferiore rotunde 3-lobato, superiore bidentato.
*Hab.* In collibus prope Tette ad ripas fluvii Zambesi, *Kirk*! *in herb. Hook.*
*Planta* herbacea, erecta. *Caulis* tetragonus. *Folia* angustissime linearia, uninervia, 3–5 unc. longa, 3–4 lin. lata. *Spicæ* pedunculatæ, 1–2 unc. longæ, confertæ. *Bracteæ* et *calyces* pilis albis glandulosis ciliati. *Corolla* vix 5 lin. longa, straminea?

11. J. FASCIATA, *E. Mey. Cat. Pl. Drèg.*—A. fasciata, *N. ab E. l. c.* p. 402.
*Hab.* In Africa australi, *Drège*! *in herb. Sonder.*; ad Port Natal, *Gueinzius*!

12. J. PETIOLARIS, *E. Mey. Cat. Pl. Drèg.*—A. petiolaris, *N. ab E. l. c.*
*Hab.* In Africa australi, *Drège*! *in herb. Sonder.*; ad Port Natal, *Gueinzius*!

13. J. BARTERI, *T. Anders.* Caule erecto, simplici, pubescente, tetragono, sulcato; foliis breviter petiolatis, lanceolatis, basi paulo attenuatis, integris, scabris; spicis ternis, terminalibus, pedunculatis, una majore centrali, duabus minoribus, a basi pedunculi majoris axillaribus; pedunculis apice incrassatis; bracteis lanceolatis, acutis, velutinis, margine breviter ciliatis; calycis laciniis subulatis, bracteis dimidio brevioribus.
*Hab.* Ad Onitshe prope ripas fluvii Quorra, *Barter*!
*Planta* herbacea, 3–4-pedalis. *Caulis* sulcatus. *Folia* 3–4 unc. longa, 1–1¼ unc. lata, subtus venosa, subglauca. *Spica* major 1½ unc. longa, pedunculo breviore. *Calycis* laciniæ non ciliatæ. *Corolla* extus villosa, cinerea, lineis notata; tubo brevi.

14. J. DEPAUPERATA, *T. Anders.* Caule subtereti, striato; foliis subsessilibus, lanceolatis, acuminatis, obsolete dentatis, supra scabris, subtus hirsutis; spicis terminalibus, longe pedunculatis, elongatis, basi laxis; bracteis lineari-lanceolatis, acutis, glabris, margine ciliatis.
*Hab.* Ad Onitshe in Africa occidentali tropica, *Barter*!
*Herba* debilis, 3-pedalis. *Caulis* pilis patentibus hirsutis inter nodos, elongatus. *Folia* remota, acute lanceolata, 1½–2 unc. longa. *Spicæ* 2–4 unc. longæ, pedunculum æquantes. *Corolla* pallide flava, *fide Barter.*

15. J. PROCUMBENS, *Linn. Fl. Zeyl.* p. 19.—Rostellularia procumbens, *N. ab E. l. c.* p. 371.—R. rotundifolia, *N. ab E. l. c.* p. 370.—R. Abyssinica, *Brongn. et N. ab E. l. c.* p. 372.—R. mollissima, *N. ab E. l. c.* p. 373.—R. crinita, *N. ab E. l. c.*—R. Royeniana, *N. ab E. l. c.* —R. simplex, *Wight, Icon.* t. 1542, *et forsan* R. glandulosa, *N. ab E. l. c.* p. 373.
*Hab.* In Abyssinia ad margines montis Scholoda, *Schimper*, n. 21!, atque in montibus umbrosis prope Axum, *in herb. Hook.*!
*Distr.* India orientalis, insul. Philipp.!, Java!, insula Timor et Nova Hollandia tropica!

16. J. TENELLA, *T. Anders.*—Rostellularia tenella *et* R. crenulata, *N. ab E. l. c.* p. 369.—R. parviflora, *Benth. Fl. Nigrit.* p. 481.
*Hab.* In Senegambia, n. 327! *in herb. Hook.*; ex insula St. Thomas, *Don*!; Princes Island in locis cultis, *Barter*!; in Provincia Emirna insulæ Madagascar, *Bojer*!, *Lyall*!

17. J. TRIFOLIOIDES, *T. Anders.*—Rostellularia reptans, *N. ab E. l. c.* p. 368.
*Hab.* In insulis Madagascar et Pemba, *Bojer*!

18. J. HAPLOSTACHYA, *T. Anders.*—Rostellularia haplostachya, *N. ab E. l. c.* p. 369.
*Hab.* In insula Madagascar, *Bojer*!

†† *Floribus axillaribus, sessilibus, solitariis, geminis vel ternis.*

19. J. NEGLECTA, *T. Anders.*—Adhatoda Rostellaria, *N. ab E. l. c.* p. 397, *cum syn. sed excl. var. β. cum syn.*
*Hab.* In Abyssinia, in dumetis parvis prope Adoam, *Schimper*, n. 106! *Plowden*!; ad Nupe prope fluvium Quorra, *Barter*!; Abeokuta, *Irving*!; ad fluvium Gambia, *Skues*!

The variety of this species, *β. humilis*, N. ab E. l. c., is a new species of *Asystasia*—*A. Schimperi*, mihi.

20. J. INSULARIS, *T. Anders.*—Adhatoda diffusa, *Benth. Fl. Nigrit.* p. 483.
*Hab.* In insula Fernando Po, *Vogel*!, *Mann*!

21. J. TUBULOSA, *E. Mey. Cat. Pl. Drèg.*—Adhatoda tubulosa, *N. ab E. l. c.* p. 392, *cum syn.*—A. leptantha, *N. ab E. l. c.* p. 390, *cum syn.*
*Hab.* In Africa australi, *Drège* ! *in herb. Hook. et herb. Sonder.*; *Ecklon et Zeyher* ! *in herb. Sonder.*

22. J. PROTRACTA, *T. Anders.*—Adhatoda protracta, *N. ab E. l. c.* p. 390, *cum syn.* (sed forsan excl. *J. Capense,* Thunb.); var. β. microphylla, *N. ab E.*
*Hab.* In Africa australi ad Uitenhage, *Ecklon et Zeyher* ! *Bowie* ! *in herb. Hook.*; ad Port Natal, *Krauss* !, *Gueinzius*; ad Howeson's Point, *in herb. Sonder.* ! Var. β. ad Port Natal, *Grant* !; ad Albany atque in regione "Ceded Territory" dicta, *Ecklon et Zeyher* ! *in herb. Sonder.*

23. J. CAPENSIS, *Thunb. Fl. Cap.* p. 478.—Adhatoda Capensis, *N. ab E. l. c.* p. 391, *cum syn.*
*Hab.* In Africa australi ad fluvium Zwartkop et ad Albany, *Ecklon et Zeyher* ! *in herb. Sonder.*

24. J. ROTUNDIFOLIA, *E. Mey. Cat. Pl. Drèg.*—Adhatoda rotundifolia, *N. ab E. l. c.* p. 391.
*Hab.* In Africa australi, *Drège* ! *in herb. Hook. et Sonder.*

25. J. HETEROCARPA, *T. Anders.* Erecta, caule tetragono, striato, hirsuto; foliis longe petiolatis, ovato-lanceolatis, hirtellis, subtus glaucis, margine integris; floribus minutis, axillaribus, sessilibus, bracteis parvis, subulatis, ciliatis; calycis laciniis subulatis, margine ciliatis; corolla calyce dimidio longiore, tenerrima; capsulis dimorphis, normali parva, compressa, glabra, tetrasperma, valvis dorso sulcatis, abnormali ovata, paulo compressa, indehiscente, 3–4-alatis, alis serrato-dentatis.
*Hab.* In rupibus umbrosis prope Tazeroo, oppidum Abyssiniæ, ad altitudinem 4000 ped., *Schimp.* ! n. 2300.
*Distr.* In Scinde !
*Herba* 6–3-uncialis. *Caulis* debilis, adscendens. *Semina* capsulæ normalis compressa, capsulæ cristatæ ovate subglobosa. Species ob capsulas dimorphas aliis speciebus generis distinctissima.

Sect. 3. GENDARUSSA. *Floribus paucis, axillaribus, pedunculatis vel solitariis bracteis minutis. Frutices vel plantæ lignosæ.*

26. J. HYSSOPIFOLIA, *Linn.*—Adhatoda hyssopifolia, *N. ab E. l. c.* p. 392.
*Hab.* In insula Teneriffæ, *Webb* ! insulis Canariis, *Bourgeau* !

27. J. CUNEATA, *Vahl, En. Pl.* i. p. 163.—Adhatoda cuneata, *N. ab E. l. c. cum syn.*—A. hyssopifolia, var. β. longibracteata, *N. ab E. l. c.*
*Hab.* In Africa australi, *Drège* ! *in herb. Hook.*; ad fluvium Zwartkop prope Uitenhage, *Ecklon et Zeyher* !; in solo indurato collium apricorum ad fluvium Zondag, *Bowie* ! *in herb. Hook.*

28. J. INCANA, *T. Anders.*—Adhatoda incana, *N. ab E. l. c.* p. 393, *cum syn.*
*Hab.* In Africa australi ad fluvium Bruck, *Burke*! *in herb. Hook.*

29. J. PATULA, *Lichtenst. in Roem. et Sch. Syst.* i. p. 164.—Adhatoda patula, *N. ab E. l. c.* p. 393.—A. pygmæa, *N. ab E. l. c.* p. 394.—A. diosmophylla, *N. ab E. l. c. cum syn.*
*Hab.* In Africa australi, *Drège*! *in herb. Hook.*; in fruticetis siccis in districtu Albany, *Bowie*!; ad fluvium Zwartkop, prope Uitenhage, *Ecklon et Zeyher*!

30. J. ORCHIDOIDES, *Linn. fil. Suppl.* p. 85.—Adhatoda orchidoides, *N. ab E. l. c.* p. 393, *cum syn.*, Gendarussa Linaria *excl.*
*Hab.* In Africa australi ad Kamaquas, *Ecklon et Zeyher*! *in herb. Drège.*

31. J. LINARIA, *T. Anders.*—Gendarussa Linaria, *N. ab E. in herb. Ecklon.*
*Hab.* In Africa australi, *Drège*!; ad Olifentsriver, *Ecklon et Zeyher*! *in herb. Sond.*

32. J. ANAGALLOIDES, *T. Anders.*—Adhatoda anagalloides, *N. ab E. l. c.* p. 403.—A. patula, *N. ab E.* partim, *in herb. Sond.*
*Hab.* In Africa australi ad fluvium Aapges, *Burke*!; ad Somerset, *Bowker*!; ad Uitenhage et Kamoo, *Ecklon et Zeyher*!

33. J. ODORA, *Vahl, En. Pl.* i. p. 164.—Adhatoda odora, *N. ab E. l. c.* p. 399, *cum syn.*
*Hab.* In montanis siccis prope "Mawer" pagum Abyssinicum, *Schimper*, n. 2135!
*Distr.* In Arabia felici!

34. J. ATHERSTONEI, *T. Anders.* Caule erecto, tereti, glanduloso-pubescente, ramis oppositis; foliis subsessilibus, oblanceolatis, apice acutis, integris, coriaceis, utrinque scabriusculo-glandulosis; floribus alternis, axillaribus, superioribus interdum oppositis, solitariis; bracteis parvis, lanceolatis; calycis laciniis lineari-lanceolatis, glandulosis; corolla calyce triplo longiore, tubo infundibuliformi; antheris loculo inferiore caudato; capsula apice subglobosa, abortu disperma.
*Hab.* In Namaqualand locis arenosis prope fluvium "An Aap River" dictum, tributarium fluminis "Orange River," *Atherstone*! *in herb. Trin. Coll. Dubl.*

35. J. MOLLIS, *E. Mey. Cat. Pl. Drèg.*—Adhatoda mollissima, *N. ab E. l. c.* p. 391.
*Hab.* In Africa australi, *Drège*!; ad Natovel, *Ecklon et Zeyher*! *in herb. Sond.*

36. J. DIVARICATA, *Willd. in herb. propr. et h. gen. Berol.* fol. 2 *et* 3.—Adhatoda divaricata, *N. ab E. l. c.* p. 391.
*Hab.* In Winterhoeksberg monte Africæ australis, *Ecklon et Zeyher*! *in herb. Sond.*

37. J. SPARTIOIDES, *T. Anders.* Caule tereti, glabro; ramis superioribus alternis; foliis paucissimis, linearibus, coriaceis, integris, uninerviis; floribus alternis, axillaribus, in infimis ramorum sessilibus; bracteis subulatis, calyce dimidio brevioribus; calycis laciniis anguste linearibus, glandulosis; corolla pubescente, tubo brevi, fauce inflata; antheris loculo inferiore calcarato.

*Hab.* In Namaqualand, *A. Wyley* ! *in herb. Trin. Coll. Dubl.*

*Suffrutex* virgatus, diffusus, fere subaphyllus, viridescens, partibus junioribus et calycibus glandulosis. *Folia* 3–8 lin. longa, ½–1 lin. lata. *Bractea* 1 lin. longa. *Corolla* 6–7 lin. longa. *Capsula* ignota.

38. J. SPERGULÆFOLIA, *T. Anders.* Caule subtetragono, sulcato, molliter pubescente, ramis oppositis; foliis sessilibus, linearibus, acutis, mucronulatis, basi attenuatis, glanduloso-pubescentibus; floribus axillaribus, sessilibus, solitariis, plerumque alternis; bracteis linearibus, pubescentibus, calycem paulo superantibus; calycis laciniis linearibus, acutis, corolla multo brevioribus; corolla labio inferiore oblongo, lobis ovatis, subæqualibus; capsula ovata, compressa, pubescente.

*Hab.* In Africa australi in Damara Land, *in herb. Trin. Coll. Dubl.* !

*Planta* subherbacea, velutino-pubescens. *Folia* ¾–1 unc. longa, integerrima. *Corolla* 4–5 lin. longa, extus puberula, intus glabra. *Capsula* 2 lin. longa, apice acuta, tetrasperma.

### Sect. 4. MONECHMA. *Floribus in spicis axillaribus, oppositis; capsula abortu disperma.*

39. J. BLEPHAROSTEGIA, *E. Mey. Cat. Pl. Drèg.*—Monechma angustifolium, *N. ab E. l. c.* p. 412*.

*Hab.* In Africa australi, *Drège* ! *in herb. Sond.*

40. J. DEBILIS, *Vahl, Symb. Bot.* i. p. 4.—Monechma debilis, *N. ab E. l. c.* p. 411, *cum syn.*—M. bracteatum, *Hochst.*, *N. ab E. l. c. cum syn.* —M. affine, *Hochst. in Flora*, 1843, p. 76, *et N. ab E. l. c.*

*Hab.* In Abyssinia prope Gapdia, *Schimper*, n. 759 !, ad pagum Kordofanum "Tejara" dictum; inter frutices in savannis, *Kotschy*, n. 261 !

*Distr.* In Arabia felici !

I have not seen *Monechma violaceum*, N. ab E. in DC. l. c. p. 411, from Abyssinia, and considered by Nees von Esenbeck to be the same as *Justicia violacea*, Vahl, Symb. Bot. i. p. 6. If they are identical, Vahl's name must be restored.

### Sect. 5. RAPHIDOSPORA. *Floribus laxe paniculatis.*

41. J. LAXA, *T. Anders.*—Adhatoda paniculata, *Benth. Fl. Nigrit.* p. 482.

*Hab.* In insula Fernando Po, *Vogel* ! *Mann* !

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* The genus *Monechma* was constituted by Nees von Esenbeck to receive some 2-seeded species of *Justicia*. Though the capsules of these species have only 2 seeds, their ovaries contain 4 ovules; in every other character they are generically *Justiciæ*.

42. J. EXTENSA, *T. Anders.* Caule erecto, pubescente; foliis petiolatis, ovatis, acutis vel lanceolatis, integris, utrinque glabris, petiolo pubescente; paniculis terminalibus trichotome ramosis, laxis, ramis patentibus; bracteis parvis, subulatis; floribus remotis, subsecundis, alternis; calycis laciniis lanceolatis, acutis, pubescentibus; capsula pubescente, ad medium compressa, sterili, apice subglobosa, tetrasperma.

*Hab.* Ad Eppah in Africa occidentali tropica, *Barter*!

*Suffrutex* 7-pedalis. *Caulis* teres, lignosus, striatus. *Folia* 3–4 unc. longa, 1–2 unc. lata, paucinervia; petiolo 1½ unc. longo. *Paniculæ* elongatæ, laxæ, patentes, pubescentes, paucifloræ. *Calyx* 3 lin. longus. *Capsula* 1 unc. longa, adscendens.

43. J. CORDATA, *T. Anders.*—Leptostachya cordata, *N. ab E. l. c.* p. 378, *cum syn.*—Raphidospora cordata, *N. ab E. l. c.* p. 499.

*Hab.* In Abyssinia ad latus montium secus flumen Tacaze infra Selassaquillam, *Schimper*, n. 1250!

44. J. GLABRA, *Koenig*, var. PUBESCENS, *T. Anders.*—Raphidospora Abyssinica, *N. ab E. l. c.* p. 500, *cum syn.*

*Hab.* Abyssinia in arborum umbra vallis Tacaze, *Schimper*, n. 903!

*Distr.* In India orientali.

45. J. CAMPYLOSTEMON, *T. Anders.*—Leptostachya campylostemon, *N. ab E. l. c.* p. 378, *cum syn.*

*Hab.* In Africa australi, *Drège*!; ad Somerset, *Bowker*!

46. J. LEPTANTHA, *T. Anders.*—Raphidospora leptantha, *N. ab E. l. c.* p. 501.

*Hab.* In insula Madagascar, *Lyall*, n. 252! *in herb. Hook.*

### JUSTICIÆ *incertæ sedis.*

47. J. ANSELLIANA, *T. Anders.*—Adhatoda Anselliana, *N. ab E. l. c.* p. 403.

*Hab.* In locis apertis ad Palmas promontorium Africæ occidentalis, *Ansell*!; ad Aboh, *Vogel*!

48. J. MANNII, *T. Anders.* Caule fruticoso, subtereti, supra nodos tumido, ramis divaricatis, lignosis; foliis ovatis, petiolatis, integris, apice acutis vel obtusis, utrinque glaberrimis, nervis paucis, crebris; floribus in spicis axillaribus? sessilibus, spicis laxis bracteis elongatis linearibus glabris; calycis laciniis bracteis brevioribus, æqualibus, ovato-lanceolatis; corolla pubescente, tubo elongato, basi angusto, limbo bilabiato, labio inferiore oblongo, fauce corrugata, segmentis ovatis, labio superiore acuto, breviter bidentato; staminibus corolla brevioribus, antherarum loculis muticis; ovario glabro, 4-ovulato.

*Hab.* In insula Fernando Po, *Mann*!

*Frutex*? glaber. *Caulis* lignosus; cortice plus minus rugoso. *Folia* 3–6 unc. longa, 1–3 lata; petiolo 1 unc. longo, superne sulcato. *Spicæ* 1 unc. longæ, laxæ, glabræ, paucifloræ. *Bracteæ* lineares, acutæ, 5 lin.

longæ, calyce duplo longiores. *Corolla* 1¼ unc. longa, extus pubescens, intus glabra, purpurea.

## XXV. SCHWABEA, *Endl.*

1. S. CILIARIS, *N. ab E., DC. Prod.* xi. p. 384, *cum syn.*
*Hab.* In Senegambia, *Heudelot*!; Nubia, *Kotschy*!; Abyssinia, *Schimper*!

2. S. SPICIGERA, *N. ab E. l. c.*
*Hab.* In Senegambia, *Heudelot*, n. 167! *in herb. Hook.*

## XXVI. MONOTHECIUM, *Hochst.*

1. M. GLANDULOSUM, *Hochst. in Schimp. Pl. Abyss.* n. 2274; *N. ab E., DC. Prod.* xi. p. 310, *cum syn.*—Rostellularia glandulosa, *N. ab E., DC. l. c.* p. 373.
*Hab.* In Abyssinia in præruptis umbrosis prope Mai Dogale, et in rupestribus herbosis monte Bellaka, alt. 6000 ped., *Schimper*, n. 617! et n. 2274!

## XXVII. ECTEINANTHUS, *T. Anders.*[*]

*Calyx* 5-partitus; laciniis subæqualibus, ciliatis. *Corolla* bilabiata, labio superiore bidentato, subfornicato; labio inferiore convexo, trifido, transversim rugoso. *Stamina* duo; antherarum loculis uno super alterum posito, subtransversim apice connectivo insertis, ovalibus, muticis. *Stigma* integrum, acutum. *Capsula* ovata, basi sterilis, obliqua, tetrasperma. *Semina* ovata, compressa; testa rugosa.

1. E. DIVARICATUS, *T. Anders.*—Rhytiglossa ciliata, *N. ab E., DC. Prod.* xi. p. 335, *cum syn.*
*Hab.* In Africa australi, ad Uitenhage et Albany, *Ecklon et Zeyher*!; ad Port Natal, *Gueinzius*!

2. E. ORIGANOIDES, *T. Anders.*—Rhytiglossa origanoides, *N. ab E. l. c.* p. 336, *cum syn.*
*Hab.* In Africa australi, *Zeyher*! *in herb. Hook.*

3. E. OVATUS, *T. Anders.*—Rhytiglossa ovata, *N. ab E. l. c. cum syn.*
*Hab.* In Africa australi, *Drège*! *in herb. Sonder.*

4. E. PROLIXUS, *T. Anders.*—Rhytiglossa prolixa, *N. ab E. l. c. cum syn.*
*Hab.* Ad Port Natal, *Krauss*!; in Africa australi, *Drège*!

5. E. ECKLONIANUS, *T. Anders.*—Rhytiglossa Eckloniana, *N. ab E. l. c. cum syn.*
*Hab.* In sylvis Olifentshoek prope Uitenhage, *Ecklon et Zeyher*!, *Sparrman*! *in herb. Sonder.*

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[*] I have constituted this genus from the African species of Nees von Esenbeck's genus *Rhytiglossa*, which is probably a strictly American genus. *Ecteinanthus* is intimately connected with *Justicia*, differing from it only in the shape of the anther-cells and the capsule.

## XXVIII. RUNGIA, *N. ab E.*

1. R. GRANDIS, *T. Anders.* Fruticosa, caule adscendente, subtereti, supra nodos tumido; foliis petiolatis, ovatis, acutis, integris, utrinque acuminatis; spicis terminalibus plerumque ternis, rarissime axillaribus, solitariis; bracteis ovatis, lanceolatis, vel parte herbacea lanceolata, acuta, margine membranaceo, crenato-corrugato; calycis laciniis lineari-lanceolatis, pubescentibus; corolla tubo brevi, labio inferiore breviter 3-lobo, centrali lateralibus latiore, labio superiore bidentato; capsula ovata, compressa, apice obtusa, pubescente, tetrasperma.

*Hab.* In Congo, *Chr. Smith*!; ad Eppah in Africa occidentali tropica, *Barter*!

*Frutex* 7–10-pedalis. *Caulis* cortice glabro. *Folia* magna, herbacea cum petiolo 4–8 unc. longa, 2–3 unc. lata, paucinervia. *Spicæ* 3–6 unc. longæ, bracteatæ, dense imbricatæ, pubescentes. *Bracteæ* 6 lin. longæ, 3 lin. latæ, portione herbacea lanceolata, plana, uninervia, margine membranaceo, transversim corrugato. *Bracteolæ* bracteis minores. *Corolla* alba. *Capsula* 5 lin. longa, 3 lin. lata.

2. R.? PUBINERVIA, *T. Anders.* Caule erecto, fruticoso, dichotome ramoso, pubescente; foliis petiolatis, lanceolatis, acuminatis, basi attenuatis, integris, utrinque puberulis, subtus reticulato-venosis, nervis incano tomentosis; spicis axillaribus, oppositis, breviter pedunculatis; bracteis imbricatis, lanceolatis, margine membranaceo, angusto, plano, bracteolis lanceolatis, membranaceis, bracteis minoribus; calyce campanulato, ad medium bifido, lacinia superiore breviter bipartita, inferiore tripartita; staminibus inclusis; antheris bilocularibus, loculis linearibus, superiore sæpe sterili, inferiore calcarato; capsula ovata, mucronata, tetrasperma, valvis lignosis, dissepimento solubili; seminibus magnis, testa rugosula.

*Hab.* In Tohiradzovu monte prope fluvium Zambesi, *Kirk*!

*Frutex* 5-pedalis. *Caulis* lignosus, apice foliatus, supra nodos tumidus. *Folia* lanceolata, 3–7 unc. longa, 1–2 unc. lata, supra viridia, obscure nervia, subtus pallidiora, nervis pubescentibus. *Spicæ* numerosæ, laxæ, 1–2 unc. longæ. *Stylus* teres, pubescens; stigmate subulato, integro. *Capsula* 5–6 lin. longa, lignosa, glabra; valvis in dehiscentia ruptis. *Semina* subglobosa; retinaculis basi e latere compressis, apice subulatis. *Corollam* marcidam vidi.

## XXIX. ANISOSTACHYA, *N. ab E.*

1. A. BOJERI, *N. ab E.*, *DC. Prod.* xi. p. 368.

*Hab.* In insula Madagascar, *Bojer*!

2. A. VELUTINA, *N. ab E. l. c.* p. 730.

*Hab.* In insula Madagascar, *in herb. Hook.*!

3. A. COMMERSONI, *T. Anders.* Caule lignoso, tereti, divaricato, glabro; foliis longe petiolatis, lanceolatis, vel ovato-lanceolatis, acuminatis, basi obliquis, integris, glabris; floribus in spicis axillaribus, spicis pedun-

culatis, geminis, una alteram superante foliis dimidio breviore, bracteis imbricatis, ovatis, obtusis, membranaceis; capsula parva, glabra.

*Hab.* In insula Joanna, *Commerson*! *in herb. Hook.*

*Suffrutex* glaber, nigrescens. *Folia* cum petiolo 3–5 unc. longa. *Spicæ* strobiliformes, glabræ; pedunculis ½–1 unc. longis, spica longioribus.

## XXX. DICLIPTERA, *Juss.*

### † *Floribus sessilibus, verticillatis.*

1. D. VERTICILLARIS, *Juss. in Mus. Ann.* ix. p. 268, *excl. syn. præter Lamarck.*—Justicia verticillaris, *Lam., sed non Linn. fil. nec Vahl.*—D. maculata, var. β. Senegambica, *N. ab E., DC. Prod.* xi. p. 485.

*Hab.* In insulis Capitis viridis, *Miller*!, *Darwin*!; in insulæ "Brava" arvis incultis, *Brunner*! *in herb. Hook.*; ad Lagos, *Barter*!

2. D. CLINOPODIA, *N. ab E., DC. l. c.* p. 483, *cum syn.*

*Hab.* Ad promontorium Bon. Spei, *Drège*! *in herb. Hook. et Sond.*

3. D. MICRANTHES, *N. ab E., Wall. Pl. As. rar.* iii. p. 112.—D. spinulosa, *Hochst. in Schimp. Pl. Abyss.* n. 509.—D. umbellata, *Juss. fid. Nees.*

*Hab.* In regno Fayzokl, *Kotschy*! *in herb. Hook.* n. 513; in montibus Abyssiniæ prope Dscheladscheranne, *Schimper*, n. 509!

*Distr.* In regionibus aridis Indiæ orientalis!

4. D. HETEROSTEGIA, *N. ab E. l. c.* p. 478.

*Hab.* In Africa australi, *Drège*; ad Port Natal, *Gueinzius*! *in herb. Sonder.*

### †† *Floribus pedunculatis, axillaribus.*

5. D. LÆVIGATA, *Juss. in Ann. Mus. l. c.*; *N. ab E., DC. l. c.* p. 476.

*Hab.* In insula Mauritii, *Bojer*!; in sylvis opacis montis Pouce, insula Mauritii, *Bouton*! *in herb. Hook.*

6. D. MADAGASCARIENSIS, *N. ab E., DC. l. c.* p. 476.

*Hab.* In insula Madagascar, *Lyall*! *in herb. Hook.*

7. D. CAPENSIS, *N. ab E. in Linnæa*, xv. p. 373; *DC. l. c.* p. 481.—D. propinqua, *N. ab E. l. c.*; *DC. l. c.* p. 477.

*Hab.* In Africa australi prope Uitenhage, *Ecklon et Zeyher*! *in herb. Sond.*

8. D. MACULATA, *N. ab E., DC. l. c.* p. 485, *cum syn. excl. var.* β. Senegambica.

*Hab.* In Abyssinia in præruptis rupium locis umbrosis prope Dscheladscheranne, *Schimper*, n. 701!, *Plowden*! *in herb. Hook.*

## XXXI. PERISTROPHE, *N. ab E.*

1. P. BICALYCULATA, *N. ab E. in Wall. Pl. As. rar.* iii. p. 113; *DC. Prod.* xi. p. 496, *cum syn.*—P. Kotschyana, *N. ab E. l. c.* p. 497.

*Hab.* In Abyssinia ad latera montium calida prope Dscheladscheranne, *Schimper*, n. 694!; in vallibus districtus Haramat prope Geraz, *Schimper*, n. 1095!; in regno Kordofan, *Kotschy*, n. 50! *in herb. Hook.*; Senegambia, *Boteler*!; insulis Capitis viridis, *in herb. Hook.*; in Africa centrali ad urbem Kouka prope oras lacus "Tsad," *E. Vogel*!; Borgu, *Barter*!

*Distr.* In Arabia felici atque in India orientali vulgatissime.

2. P. CAULOPSILA, *N. ab E. l. c.* p. 498, *cum syn.*—P. cernua, *N. ab E. l. c. cum syn.*

*Hab.* In Africa australi, *Drège*!; in agris prope flumen Zwartkop, *Zeyher*! *in herb. Hook. et Sond.*; in districtu Uitenhage ad flumen Zemgagh, *Bowie*!, *Harvey*!, *Ecklon et Zeyher*!

3. P. NATALENSIS, *T. Anders.* Caule erecto, 5-angulari, ramis divaricatis; foliis petiolatis, ovato-lanceolatis, basi rotundatis, margine integris, utrinque tomentosis; floribus pedicellatis, bracteis parvis, subulatis, acutis; bracteolis 2, ad calycem adpressis; calycis laciniis æqualibus, lanceolatis, extus puberulis, intus glabris; corolla profunde bilabiata, labio inferiore ovato, subintegro.

*Hab.* Ad Port Natal, *Gueinzius*! *in herb. Hook. et Sonder.*; *Sanderson*! *in herb. Hook.*

*Planta* herbacea. *Caulis* angulatus, glaber, sed ad angulos subciliatus, supra nodos paulo tumidus. *Corolla* fere uncialis, extus pilis simplicibus sparse pubescens, in sicca purpurea.

## XXXII. HYPOESTES, *R. Br.*

† *Floribus axillaribus, solitariis.*

1. H. UNIFLORA, *Hochst. in Schimp. Pl. Abyss.* n. 400.

*Hab.* Ad rupes calidas regionis inferioris in parte australi Scholoda montis Abyssinici, *Schimper*! *in herb. Hook.*

2. H. MACULOSA, *N. ab E., DC. Prod.* xi. p. 503, *cum syn.*

*Hab.* In insula Madagascar prope Tananarivou, *Bojer*!

3. H. HIRSUTA, *N. ab E. l. c.* p. 504.

*Hab.* In insula Madagascar, *in herb. Hook.*!

†† *Floribus in verticillis axillaribus.*

4. H. ARISTATA, *Soland. in Roem. et Sch. Syst.* i. p. 140; *N. ab E., DC. l. c.* p. 509, *cum syn.*

*Hab.* In Africa australi ad Uitenhage, *Drège*!, *Ecklon et Zeyher*!, *Forbes*!

††† *Floribus in spicis axillaribus, secundis.*

5. H. VERTICILLARIS, *Soland. in Roem. et Sch. Syst. l. c.*; *N. ab E., DC. l. c.* p. 507, *cum syn., forsan excl.* H. polymorpha, *Schlecht.*—H. clinopodia, *E. Mey. Cat. Pl. Drèg.*; *N. ab E., DC. l. c.* p. 508.

*Hab.* Prope Uitenhage, *Drège*! *Ecklon et Zeyher*!; ad Port Natal, *Gueinzius*! *R. W. Plant*, *Grant*!; Algoa Bay, *Forbes*!; ad "Vaal River," *Burke*!—Var. *glabra*, T. Anders., ad Somerset in Africa australi, *in herb. Hook.*!

6. H. MOLLIS, *T. Anders.* Caule subtereti, velutino; foliis longe petiolatis, ovatis, utrinque acuminatis, margine integris, supra subglabris, subtus tomentosis; spicis axillaribus, secundis, pilis patentibus pubescentibus; bracteis subulatis, tomentosis; calycis laciniis acutis, ciliatis; corolla parva, pubescente; capsula calyce duplo longiore, acuta, pubescente.

*Hab.* In Congo, *Chr. Smith* ! *in herb. Hook.* (*olim in herb. cl. R. Brown*).

*Herba* erecta, molliter tomentosa. *Caulis* striatus. *Folia* 2 unc. longa, petiolum æquantia. *Spicæ* sessiles, axillares, oppositæ, et subterminales confertæ secundæ. *Calyx* 3–4 lin. longus. *Corolla* calyce duplo vel triplo longior.—Exemplum imperfectum ex herbario infelicis Chr. Smith vidi.

7. H. FORSKALEI, *R. Br. Prodr. Fl. Nov. Holl.* i. p. 474; *N. ab E.*, *DC. l. c.* p. 507, *cum syn.*

*Hab.* In Abyssinia in monte Scholoda prope Adoam, *Schimper*, nn. 405! et 1861!

8. H. ROTHII, *T. Anders.* Caule subtetragono, glabro; foliis petiolatis, ovatis vel lanceolato-ovatis, acutis, margine sinuatis, supra glabris, subtus glabriusculis; spicis axillaribus subterminalibusque, paucifloris, tomentosis; bracteis in tubum coalitis, supra medium liberis; bracteolis bracteis inclusis parvis, subulatis, scariosis; calycis laciniis lanceolatis.

*Hab.* In Abyssinia ad Anhober, *Dr. Roth* ! *in herb. Griffith* !, *Plowden* !

*Planta* herbacea, erecta. *Folia* 1–2 unc. longa, sæpe utrinque acuta. *Spicæ* folia subæquantes, secundæ. *Bracteæ* calyce bracteolisque multum longiores.

9. H. INSULARIS, *T. Anders.* Caule obtuse tetragono, striato, pubescente; foliis petiolatis, ovato-lanceolatis, utrinque acuminatis, supra ad nervos hirsutis, subtus pubescentibus, petiolis marginibusque ciliatis; spicis axillaribus, sessilibus, bracteis basi coalitis, lineari-lanceolatis, acutis, glabris, margine paulo ciliatis; bracteolis scariosis, subulatis, calyce dimidio brevioribus; calycis laciniis ad medium connatis, æqualibus, subulatis; corolla elongata, angusta, profunde bilabiata, extus hirsuta, intus glabra, labio inferiore ligulato, integro.

*Hab.* In insula Fernando Po, *Mann* ! *in herb. Hook.*

*Planta* herbacea, pubescens. *Caulis* pubescens, angulis subciliatis. *Folia* integra, 4–5 unc. longa, 1–2 unc. lata. *Spicæ* petiolum æquantes. *Corolla* fere uncialis, purpurea.

10. H. BARTERI, *T. Anders.* Caule subtetragono, glabriusculo, ramoso; foliis longe petiolatis, ovatis, acutis, utrinque glabris, margine integris; spicis axillaribus, ramosis, pedunculatis vel sessilibus, solitariis vel 3–4 confertis; bracteis basi coalitis, linearibus, acutis, calyce longioribus; calycis laciniis parvis, subulatis, scariosis; corolla labio inferiore obovato, 3-dentato.

*Hab.* Ad Eppah prope flumen Quorra, *Barter* !

*Suffrutex* 4-pedalis, glaber. *Caulis* erectus, sulcatus, angulis obtusis.

*Folia* cum petiolo 6–7 unc. longa, 1–3 unc. lata. *Spicæ* laxæ, 2–7 unc. longæ, subsecundæ, glabræ. *Corolla* extus pubescens, lilacina.

11. H. LATIFOLIA, *Hochst. in Kotschy, Pl. Nub.* n. 296; *N. ab E., DC. l. c.* p. 509.
*Hab.* In Senegambia, *Heudelot*! n. 992? vel 972.

12. H. TRIFLORA, *Roem. et Sch. Syst.* i. p. 88; *DC. l. c.* p. 506, *sed excl. syn.*—H. acuminata, *Hochst. in Schimp. Pl. Abyss.* n. 1985.
*Hab.* Ad latus boreale montis Scholoda prope Adoam, *Schimp. Pl. Abyss.* n. 1985!

13. H. LASIOSTEGIA, *N. ab E., DC. l. c.* p. 504.
*Hab.* In insula Madagascar, *in herb. Hook.*!

14. H. SAXICOLA, *N. ab E., DC. l. c.* p. 503.
*Hab.* In interiore insulæ Madagascar, *Bojer*!

†††† *Floribus spicatis, terminalibus.*

15. H. GRACILIS, *N. ab E., DC. l. c.* p. 506.
*Hab.* In insula Madagascar, *Lyall*! *in herb. Hook.*

16. H. FLEXIBILIS, *N. ab E., DC. l. c.* p. 505.
*Hab.* In insula Madagascar, *Lyall*!

17. H. SPICATA, *N. ab E., DC. l. c.* p. 504.
*Hab.* In dumetis ad versuras agrorum provinciæ Emirnæ Madagascar, *Bojer, Lyall*!

18. H. FASCICULARIS, *N. ab E., DC. l. c.*
*Hab.* In silvaticis montosis provinciæ Emirnæ Madagascar, *Bojer*! *in herb. Hook.*

19. H. OXYSTEGIA, *N. ab E., DC. l. c.* p. 505.
*Hab.* In insula Madagascar, *Lyall*! *in herb. Hook.*

20. H. PULCHRA, *N. ab E., DC. l. c.*
*Hab.* In insula Madagascar, *in herb. Hook.*!

21. H. ANISOPHYLLA, *N. ab E., DC. l. c.* p. 503.
*Hab.* In insula Madagascar, *in herb. Hook.*!

22. H. BOJERIANA, *N. ab E., DC. l. c.* p. 506.
*Hab.* In silvis umbrosis secus rivulos provinciæ Emirnæ insulæ Madagascar, *Lyall*! *in herb. Hook.*

23. H. DICLIPTEROIDES, *N. ab E., DC. l. c.* p. 510.
*Hab.* In insula Madagascar, *Lyall*! *in herb. Hook.*

### XXXIII. RAMUSIA, *N. ab E.*

1. R. TRIDENTATA, *N. ab E., DC. Prod.* xi. p. 309, *cum syn.*
*Hab.* In Africa australi ad Port Natal, *Gueinzius*! *Drège in herb. Sond.*! *et Hook.*!

### XXXIV. BRACHYSTEPHANUS, *N. ab E.*

1. B. LYALLII, *N. ab E., DC. Prod.* xi. p. 511.
*Hab.* In insula Madagascar, *Lyall*! 249 *in herb. Hook.*

### XXXV. RHINACANTHUS, *N. ab E.*

1. R. COMMUNIS, *N. ab E., DC. Prod.* xi. p. 442, *cum syn.*—R. osmospermus et R. Rottlerianus, *N. ab E. l. c.* p. 443.
*Hab.* In insula Madagascar ex regione interiore, *Bouton*!; in insula Mauritii sed certe non spontaneus, *in herb. Hook.*!
*Distr.* Suffrutex in hortis regionum tropicarum Asiæ cultus; forsan in sylvis montium Neilgherriensium et Javanicorum indigenus.

2. R. OBLONGUS, *N. ab E. l. c.* p. 444, *cum syn.*
*Hab.* In Chumi monte regionis Caffrorum, *Ecklon et Zeyher*!

### XXXVI. GRAPTOPHYLLUM, *N. ab E.*

1. G. HORTENSE, *N. ab E. in Wall. Pl. As. rar.* iii. p. 285; *DC. Prod.* xi. p. 328.
*Hab.* In Sierra Leone, et insula Mauritii, in hortis cultum, *Barter*! *in herb. Hook. ex horto botanico Mauritii*!
*Distr.* Patria ignota, sed per totum orbem tropicum, ob flores speciosas foliaque variegata, introducta. In insulis Amicis (an indigena?), *Harvey*!

### XXXVII. HAPLANTHERA, *Hochst.*

1. H. SPECIOSA, *Hochst. nov. gen. pl. Afric. in Flora,* 1843, p. 71; *N. ab E., DC. Prod.* xi. p. 308.
*Hab.* In Abyssinia secus ripas fluvii Tacaze, *Schimper*, n. 769!, *Plowden*! *in herb. Hook.*

### XXXVIII. RUTTYA, *Harv.*

1. R. OVATA, *Harv. in Loud. Journ. of Bot.* i. p. 27; *N. ab E. in DC. Prod.* xi. p. 309, *cum var. et syn.*
*Hab.* In Africa australi ad Port Natal, *Gueinzius*! *Williamson*! *in herb. Hook., et Harvey*; *Drège*! *in herb. Sonder.*

### XXXIX. ERANTHEMUM, *Linn.*

1. E. NIGRITIANUM, *T. Anders.* Caule erecto, tereti, subglabro; foliis petiolatis, ovato-lanceolatis, acuminatis, margine integris, utrinque glabris; spicis terminalibus vel subaxillaribus, dichotomis, parvifloris; calycis laciniis lanceolatis, subulatis, corolla capsulaque multo brevioribus; corolla hypocraterimorpha, limbi lobis subæqualibus; staminibus subinclusis, anantheris 2 brevioribus; capsula parte sterili elongata, acuta, glabra, valvis dorso sulcatis, in semina paulo constrictis.
*Hab.* In insula Fernando Po, *Mann*!

*Suffrutex* pedalis. *Partes veteres* glabræ, *juniores* tomento ferrugineo puberulæ. *Folia* breviter petiolata, integra, glabra, 3–5 unc. longa, 1–2 unc. lata. *Spicæ* virgatæ, breviter bracteolatæ, puberulæ, 4–8 unc. longæ. *Corollæ* tubus 1 unc. longus, angustissimus. *Capsula* apice 4-sperma. *Semina* compressa, testa rugosa.

2. E. HYPOCRATERIFORME, *Roem. et Sch. Syst. Veg.* i. p. 175; *N. ab E.*, *DC. Prod.* xi. p. 454, *cum syn.*
*Hab.* Ad Sierra Leone, *Vogel* ! *in herb. Hook.*

3. E. DECURRENS, *Hochst. in Kotsch. et Schimp. Pl. Abyss.*; *N. ab E. l. c.* p. 453.
*Hab.* In umbra arborum ad fluvium Abyssinicum Tacaze, *Schimper*, n. 773 ! *in herb. Hook.*

## XL. DICENTRANTHERA, *T. Anders.*

*Corolla* infundibuliformis; limbo 5-fido; lobis ovatis, æqualibus; tubo ad medium constricto. *Stamina* 4, didynama, filamentis per paria basi connatis; antheris bilocularibus, loculis ovatis, inæqualibus, basi bicalcaratis, mucronibus rigidis, uno longiore. *Stylus* teres, puberulus; stigmate apice recurvo, bidentato; lobis patentibus. *Ovarium* basi annulo crasso, crenato cinctum, 4–6-ovulatum. *Capsula* ignota.

1. D. MACROPHYLLA, *T. Anders.* Suffruticosa, caule erecto, cortice glabro; foliis petiolatis, oblongis, apice acuminatis, basi attenuatis, margine integris, paucinerviis, utrinque glabris; spicis terminalibus, solitariis, laxe multifloris; corolla infundibuliformi, tubo elongato, limbo subcampanulato, lobis æqualibus.
*Hab.* In montosis insulæ Fernando Po, *Mann* !
*Suffrutex* partibus, foliis exceptis, nigrescentibus. *Caulis* subtetragonus, glaber. *Folia* pedalia, 4 unc. lata, basi longissime attenuata; nervis 6–10. *Flores* in spicis verticillatis, bracteatis. *Spicæ* pedales, paniculatim ramosæ. *Calyx* parvus; laciniis æqualibus, sublobatis. *Corolla* 1½–2 unc. longa, utrinque glaberrima. *Stamina* 4, didynama; antheris bilocularibus, omnibus fertilibus; loculis basi bicalcaratis.

## XLI. ASYSTASIA, *Blume.*

1. A. GANGETICA, *T. Anders. in Enum. Pl. Zeyl.* p. 235.—A. Coromandeliana, *N. ab E.*, *DC. Prod.* xi. p. 165, *cum syn.*—A. quaterna, A. intrusa, A. Bojeriana, *N. ab E. l. c.* p. 166.—A. Comorensis, *Bojer et N. ab E. l. c.*—A. Capensis, *N. ab E. l. c. cum syn.*—A. calycina, *Benth. Fl. Nigrit.* p. 478.
*Hab.* In Africa tropica et insulis copiose, ad promontorium "Palmas" et "Grand Bassa," "Cape Coast," *Vogel* !; Senegambia, *Skues* !; Jebba ad fluvium Quorra, *Barter* !; Fayzokl, *Kotschy*, n. 423 ! *in herb. Hook.*;

ad ripas fluvii Suabo tributarii Zambesi, *Kirk* !; Port Natal, *Plant* !, *Krauss* !, *Drège* !; Bombatooka in insula Madagascar, *Bojer* !, *Lyall* !
*Distr.* Per totam Asiam tropicam ab Arabia ad insulam Java.

This is a widely distributed and very variable tropical weed, whose African forms have been described under the names I have quoted above. The remainder of the synonymy will be found at p. 235 of Thwaites's 'Enumeration of Ceylon Plants.' The colour of the corolla is generally pale yellow or white, with a few light purple spots on the lower lip.

2. A. **Schimperi**, *T. Anders.*—Adhatoda Rostellaria, var. β. humilis, *N. ab E. l. c.* p. 397, *cum syn.*
*Hab.* Abyssinia in graminosis prope Goelleb, ad altitudinem 4000 ped., *Schimper*, n. 2220 !, et in vallibus prope Dscheladscheranne, *Schimper*, nn. 1657 ! et 1659 !

3. A. **Vogeliana**, *Benth. Fl. Nigrit.* p. 479.
*Hab.* Ad vias in fruticetis in insula Fernando Po, *Vogel* !, *Mann* !; ad Abeokuta in Africa tropica occidentali, *Irving* !; in sylvis prope Angiama, *Barter* !

4. A. **scandens**, *Hook. Bot. Mag.* t. 4449, *excl. syn.*—A. quaterna, Ruellia quaterna, *et* Henfreya scandens, *Lindl. Bot. Reg.* 1847, *sub* t. 23.
*Hab.* In Sierra Leone, *Don* !, *Barter* !

## XLII. Mackaya, *Harv.*

1. M. **bella**, *Harv. Thesaur. Cap.* i. p. 8. t. 13.
*Hab.* Inter saxa alveo fluvii "Tongat" prope Port Natal, *Sanderson* ! *in herb. Hook.*

[The following species are described as new by the late Dr. Klotzsch in the Botany of Peters's 'Reise nach Mossambique.' The work was published in 1862 at Berlin, and has not reached Dr. Anderson.

*Asystasia podostachys.* Zanzibar.
—— *subhastata.* Boror.
—— *floribunda.* Boror.
—— *acuminata.* Querimba.
—— *pubescens.* Mossambique and Anjoana Island.
—— *scabrida.* Mossambique.
—— *multiflora.* Zanzibar.
—— *Querimbensis.* Querimba.
*Barleria rhynchocarpa.* Querimba Island.
—— *Querimbensis.* Querimba Isl.
*Barleria consanguinea.* Rios de Sena.
—— *squarrosa.* Rios de Sena; Tette.
—— *spinulosa.* Querimba, mainland.
—— *Senensis.* Rios de Sena.
—— *capitata.* Rios de Sena.
*Blepharis pungens.* Tette (*vide supra*, p. 34).
—— *acanthodioides.* Rios de Sena.
*Crossandra pubescens.* Boror.

*Crossandra puberula.* Rios de Sena.
*Adhatoda formosissima.* Rios de Sena; Tette.
—— *striata.* Rios de Sena.
—— *Mossambicensis.* Mossambique Island.
—— ? *microphylla.* Mossambique Island.
*Rhinacanthus gracilis.* Goa Island.
*Eranthemum Senense.* Rios de Sena; Boror.
*Blechum hamatum.* Rios de Sena.
*Dicliptera Mossambicensis.* Island and mainland of Mossambique.

Herb. Kew., 19 Feb. 1863.]

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## On the Spiral Markings of the Flocci in the Genus *Trichia*.

### By the Rev. M. J. Berkeley, M.A., F.L.S.

[Read April 17, 1862.]

A good deal of controversy has arisen respecting the real nature of the spiral markings in the genus *Trichia*, which were first observed by Schmidel and the younger Hedwig, and afterwards more exactly, on modern improvements in the microscope, by Klotzsch and Corda, who were probably, at the time they made their observations, unaware of the earlier notices. The accuracy of Corda's drawings has, however, been called in question; and mycologists, a few months back, were pretty equally divided on either side, the one regarding the threads as real spiral vessels, the other insisting that the spiral lines were due to torsion, while Mr. Currey advocated a third opinion, in which he has been followed by De Bary and Wigand, viz. that the markings were due to elevations in the threads assuming a spiral direction.

The question has again been brought immediately under my notice by some observations of Mr. Knight, sent in a letter to Dr. Hooker from New Zealand, an extract of which I shall beg to lay before the Society.

"I notice," writes Mr. Knight, "in the review of Mr. Berkeley's 'Outlines of British Fungology' in the 'Natural History Review' of January 1861, p. 8, that the reviewer states, in respect of spiral vessels, that it is true that all the species of *Trichia* contain threads, all of which bear spiral markings, but the nature of these markings is still a subject of controversy.

"That these threads are true spiral threads I cannot doubt. I should, three or four years ago, have drawn your attention to the observations I had made on the subject, had I not been under the impression that the controversy had ceased, and the spiral nature of those cells been admitted.

"I send you now a tracing of a sketch which I made several years ago. You will see that there are three distinct continuous spirals—not asperities, nor what the reviewer terms arcuate elevations of the cell-wall following a spiral direction. That there may be no doubt of the correctness of the observation, I enclose for Mr. Berkeley a few specimens of a *Trichia* collected here. I have had them some time, and they may not be so well adapted for observation as when in a living state. With a good microscope and a $\frac{1}{5}$ object-glass the spirals are brought out quite distinct, but a $\frac{1}{8}$ may be necessary to enable one to count the number of spirals.

"Previous to observation, the specimen should be placed for a few hours in cold water, and then in boiling water. A shallow eye-glass would be best to use with the $\frac{1}{5}$; otherwise, from the age of the specimen, the crossing of the threads will give the appearance of asperities. The size of the spores is at least four times too great to admit of there being a spore attached to each asperity."

Just after the receipt of Mr. Knight's communication, a very learned paper, by Herr Wigand, appeared in Pringsheim's 'Jahrbücher für wissenschaftliche Botanik' (published at the end of November 1861) on the genus *Trichia* and the nearly allied genus *Arcyria*, which differs principally from *Trichia* in the absence of spiral markings, or rather in the frequent substitution of rings instead of spirals. The memoir is accompanied by numerous and most careful figures; and while it is quite convincing as to the threads bearing a very close relation to the spiral vessels of higher plants, it shows at the same time that they cannot be considered (at least, so far as herbarium specimens show) as vessels containing a free spiral thread, or even a raised spiral thread attached to the inner walls, but rather as having an elevation of their walls from within in a spiral direction, so as to leave a groove externally between each volution of the spiral,—the hollow of the spiral itself being filled up afterwards, it should seem, by the deposition of new matter, though never in such a degree as to produce a raised spiral thread within the tube: they resemble, in fact, if I may be allowed to use the illustration, a male screw rather than a female. As a proof of the deposit being subsequent to the spiral elevations, he adduces the fact that when first formed they are colourless, and that they only become opake at a later period of development. In certain states of *Trichia furcata*, as in *Arcyria punicea*, he finds rings instead of spirals, and, in some threads of the former, rings and spirals at the same time, with the addition of bladder-like swellings or beads towards the extremities. In *Trichia abietina* the spiral branches, and after two or three volutions becomes simple again, then running in a horizontal direction so as to form imperfect rings, and then again becoming oblique, exactly after the fashion of the mixed vessels of Phænogams. Such phases, it is clear, could never be presented by any twisting of a flat thread, even where there is one spiral alone—not to mention the fact that the threads are, from their earliest growth, not flat, but cylindrical—much less where the threads themselves are branched and, at the same time, irregular in outline, as is frequently the case. Till a thin vertical slice from a thread can be obtained, it may be impossible to say, so positively as to convince all gainsayers, notwithstanding the deeper tint, whether there is really any deposit in the inside of the threads corresponding to the spiral markings, though in any case the elevations are due simply to some action *within*, which takes place in a spiral or circular direction, passing occasionally from the one into the other.

I have examined Mr. Knight's specimens, prepared precisely according to his directions, and with an object-glass of $\frac{1}{8}$ I see, clearly enough to satisfy myself, that there is a depression in the membrane of the thread between each spiral, exactly as the structure is figured by Wigand, and, indeed, previously by Mr. Currey*, though, at the same time, it seems clear to me that there is no twisting of the thread, and that the appearance could never have been brought about by mere torsion. In *Batarrea* I have seen the vessels more closely approaching the type in Phænogams; and, unless I am greatly deceived, I have on former occasions, in individuals of *Trichia* which had just passed from the milky stage, seen nearer approaches to this than any which are figured in Wigand's plates. Be this, however, as it may, whether the difference be greater or less, it is pretty certain that the spiral marking of the threads is a case rather of affinity than analogy; and we cannot entirely deny the existence of spiral vessels in fungi, though they may exhibit a somewhat different type from that to which we are accustomed. I have seen precisely the same arcuate elevation in the cells of *Sphagnum*, respecting the spiral threads of which I believe there is no doubt.

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* Quarterly Journal of Microscopical Science, vol. iii. pl. 2. fig. 4.

## Journal of an Expedition to the Coast and Capital of Madagascar, in the suite of the late Mission to King Radama. By CHARLES MELLER, M.D., Medical Attendant to the Embassy. Communicated by Sir W. J. HOOKER, F.R.S. & L.S.

[Read Dec. 4, 1862.]

H.M.S. Gorgon, Port Louis, Mauritius,
Sept. 10, 1862.

MY DEAR SIR WILLIAM,—I apprised you, in a letter written from the Naval Hospital at the Cape in June last, of the circumstances that had brought me there, and of those that made me very desirous to leave it and return to the Zambesi by the 'Gorgon'; to wit, the prospect of being attached to the Embassy deputed to carry addresses and presents from our Government to King Radama. Capt. Wilson of the 'Gorgon,' as a Commissioner, offered to attach me to his party as medical attendant, so that in such capacity I might have opportunity of collecting; and Dr. Shea, of the Naval Hospital, believing that a good sea voyage would do more for the relief of the enlarged spleen and remains of fever than a protracted residence in hospital, advised that I should request a passage from Admiral Walker, with this double purpose in view. A passage was readily granted. On arriving at Mauritius we found that Sir William Stevenson had organized an embassy, of which Major-General Johnstone was to be head, and Capt. Anson, R.A. (Inspector-General of Police), and Capt. Wilson of the 'Gorgon' Joint Commissioners, Lieut. Oliver, R.A., Aide-de-camp to the General, and myself as Medical Attendant. The Bishop of Mauritius subsequently joined the party, having a special errand to accomplish. The Queen's presents had been previously despatched under charge of an officer in the Colonial Department. Arriving at Tamatave on the 13th of July, we resided for a week in some houses set apart for the Embassy, whilst preparations were made for conveying the stores, &c. During this time official visits had to be made to the Governor and other officers; and I availed myself of invitations to their country houses, for the purpose of collecting specimens, and for information. The utmost cordiality was shown on every occasion to the Embassy or individuals of it, and every facility offered for acquiring information.

Marmites being obtained, and everything in readiness for the journey, we left Tamatave on the 22nd of July. The distance between Tamatave and Antananarivo was calculated, by the Mission which went from Mauritius to congratulate the King on his accession, at 225 miles; but as none of the gentlemen walked the distance, I am afraid they computed wrongly. We took the same number of days (17) from the one place to the other; and I walked the whole distance, with the exception of the first and last five miles, over which we had to be carried for the sake of leaving and entering these towns in due form; and I came to the conclusion that it is not more than 190 miles between these places, and that Antananarivo is not more than 130 miles from the sea at that part where, after walking south from Tamatave, we turn due west to penetrate the country. The first 60 miles of the road lie along the coast, on a spit of sand separating the sea from a chain of lakes, and sometimes so narrow that the sea at high water communicates with them. The first day's march was over a sandy plain, and across commons, on the short grass of which the herds of oxen collected near Tamatave for exportation were feeding. Skirting the sea, by Tamatave, is a dense wood or copse, with a few stout trees in it, used by the natives for making their smaller canoes, and which I believe to be a species of *Inophyllum*. There is abundance of wild coffee-shrubs in it, and of two species of Brexiads. Studding the plains about Tamatave, and more especially along the sea-board, is a *Logania*, called by the natives Voantaka—the same as that found by the Zambesi and Shiré. It yields an abundance of fruit, which is consumed (less the seeds) by the natives with avidity. With it, but much less frequently met with, is a *Clusia* (?) with edible fruit, and a *Zizyphus*, called Masaon by the Portuguese of the Zambesi, and Mason by the Mauritians. It is abundant in Mauritius, by the Zambesi, in Shiré, and Rovuma. There is not much of it on our road from Tamatave, and it was not seen after leaving the sea. Ornamenting the gardens of some of the merchants at Tamatave, and forming part of the sea-board bush, are two species of *Barringtonia*—one apparently the same as that found at Mohilla and Johanna (the fruit sent home in box No. 4), specimens of which were forwarded last February. The Copal gum-tree is very abundant along the sea, and for 70 miles of our way inland, being lost after this (the last tree seen being at about 800 to 1000 feet above the sea-level). It grows to a larger size than other trees I have seen; one found by the lakes about 29 miles from Tamatave measured 28 feet in circumference, had an enormous spread, and was full of fruit. Very little gum is collected. The natives incise the bark, and fix bamboos to receive the gum: to procure india-rubber they are less careful, merely making incisions, and allowing the sap to flow into a hole at the root of the tree. The natives procure their india-rubber from a trailing and climbing plant, whose order I am unacquainted with: it has thick cordate leaves, pear-shaped and -sized fruit, native name "Vaughina." (Fruit and india-rubber sent in box No. 4.) The *Ficus elastica* is found along the sea-board route, and a *Theophrasta*; but I am not aware that the Malagasy have recourse to these. In the journey by the coast the Morads, Euphorbias, and Myrtles are well represented. Dense, spreading, Box-like trees are held in great respect by the Betsimasaraks (a tribe of the south), who resort to these and other shade-affording trees, such as Lichis and Mangos, from devotional motives; and it is common to see beneath them the sticks, rags, and bamboos which devotees leave after paying their vows to the gods. The bamboo generally contains some rum or Betsibeti (the native rum) to propitiate the deities in favor of the supplicant who has left it. Ferns decorate trees, living and dead, on this part of the road; but they are far less varied than in that part which lies through the forests, where every tree is covered with lichens and mosses, and decayed trunks are shrouded in parasitic growths. The *Asplenium* (Corne de Bœuf; I am ignorant of its specific name), a *Pteris* (?), and several forms of *Polypodium* are most common, and many more with which I am unacquainted. Of Orchids the *Angræcum sesquipedale* and *superbum* are most prominent and numerous; they grow parasitic and terrestrial, from Tamatave, along the coast-line and for 60 miles inland, being lost sight of at about the same elevation as the Copal-tree. Three smaller species of *Angræcum* are also found, one sweet-scented, with a small white-flowered spike 1 to 1¾ foot long, and one with flowers alternately yellow and white; also a species of *Vanda* and two of *Dendrobium*, noticed by Mr. Ellis and pointed out to me in districts lying away from our road.

Growing in the plains to the height of 12 to 14 feet, from Tamatave to 20 miles inland, were two species of *Daphne*—one pink and the other white-flowered, both sweet-scented. A most conspicuous thriving shrub, a wild Mulberry, is found for the same distance; and the ground is studded with the *Vinca rosea* and several Acanthads (the same seen in Mauritius), and a blue-flowered *Lobelia*, and many more of whose class or name I am ignorant. Whilst the route lies by the lakes, two kinds of *Hibiscus* are conspicuous—one yellow-flowered, the other pink. Both trees afford, in their bark, material from which fine twine is made by the natives. There is another tree of the same form (with long cordate pointed leaves), called "Lafa," from the bark of which a coarser kind of cord is made.

On the second day's journey, a wide river, the Herondro, had to be crossed, and the road lay through a wide plain studded with decaying timber and leafless withered trees. Herds of oxen, thousands in number (one owner alone having 4000), fed here; and the grass was luxuriant, though the trees were mostly dead. Bleached, leafless trees, standing sentinel-like over the fallen, were topped or studded with earth-balls, the houses of the red ant; and of the fallen timber many had these deformities on them, and the covered ways of the red ants, which exist in great force on this part of the road. There is no indication of grass firing, no dearth of water or soil; yet few of the thousands of trees here have life. (Have the ants anything to do with this?)

The *Tanghinia veneniflua*, Voan Tangan of the Malagasy (the ordeal poison-tree), grows along the coast. It was in full flower and fruit as we passed. It is one of the most beautiful trees seen in the journey, and very abundant. From one of the Christians at Antananarivo, who went through the ordeal during the days of persecution in the late Queen's reign, I learnt the mode of its administration. The fruit was taken, bruised, and boiled whole. A fowl was boiled, and the broth set aside. Three pieces of the skin of the fowl were cut and put into the broth. A cupful of the poison was first administered, followed by another of the broth containing the three pieces of skin. If vomiting did not speedily set in, the poison soon killed; but if it did, it was kept up by constant exhibition of the broth and warm water, until the three pieces of skin were ejected. Should these obstinately remain, it was held as evidence of guilt, and another dose of the poison was administered.

Hanging from the fork of a tree by one of the lakes, I found a pendent ribbon-like fern*, the roots of which were fixed in a mass of earth and decomposed leaves collected in the hollow of the tree. Each ribbon fell to a distance of from 3 to 5 feet, then bi- or trifurcated, and from the under part sent down a spore-case, which contained in the ripe state a mass of yellow granular matter. The primary divisions fell from 1 to 3 feet more, then subdivided, and beneath each subdivision was a spore-case connected by a diverticulum. Some of these bands measured 12 feet.

Lining the beach from Tamatave to Andovorant, the point from which the road turns westward, are two species of *Pandanus* or

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* *Ophioglossum pendulum.*

Vacoa, and the Filhao tree. The Vacoa forms a thick, strong barrier against sand-drift, and is planted by the natives around villages by the sea with this intent. It forms a more complete barrier than the Hottentot Fig at the Cape.

Several species of Aloes grow in the same locality, a *Zamia* and the Brexiads before mentioned, also a Laurel-looking shrub with bunches of white berries. A *Cytisus* rising to 6 feet flourishes here, and is again met with on the red-clay hills near the capital, but not on the road between.

I have sent a specimen of the sand taken from the border of a brackish lake by the sea. It is found also inland by the rivers. It stains the hand black. It is very heavy, and full of shining particles like pulverized plumbago.

From Andovorant we leave the sea, take canoes up a lake for 8 or 10 miles to reach the first village of the ascent, and from the road being hitherto of sand it changes to fine yellow clay composing the banks of the lake, superimposed on which is a layer of loam, in which were growing, at the time we passed, some very good sugar-cane and *Gossypium*: there is only one species of cotton in the south; it is coarse, and of short staple. On either side of the lake are rising hills, the ravines between which are filled with Bamboo and *Ravenala*, the Traveller's Tree. This tree is met with here for the first time on the road, and is the companion of the traveller for 130 miles after leaving the coast, being lost sight of after reaching an elevation of about 2500 feet. It has been thought, by some gentlemen at Mauritius who have visited Madagascar, that Mr. Ellis was mistaken when he said that some of these trees rose to 30 feet in height. During our return journey from the capital the Bishop of Mauritius and I observed several of this altitude, and one, in a ravine near Ampassimbi (a village about 2000 feet above the sea), at least 40 feet high. At the end of the lake a canal is entered, passing through paddy-fields of fine rice; and at this part the banks were covered with ferns and the Stag's-horn moss: the Arums described by Mr. Ellis are, as he says, gigantic, and line each side of the lakes and canals. Overhanging the canal were several of the *Astrapæa Wallichii* in flower; a myrtle; the "Jambrosin" (the same found at Mauritius, with the same name, fruit edible); and an *Erythrina* with heads of scarlet flowers "like bunches of French-bean flowers," 40 to 50 feet high, with a trunk 4 feet in circumference, and wide-spreading branches—native name "Asamboion." On the banks too are several brilliant *Convolvuli*, the *Mucuna pruriens*, a *Poly-*

*gala* used by the natives as medicine for gastric irritation, and a blue-flowered small *Solanum* the leaves of which are eaten as a vegetable by the natives, who call it "Bred." It is sold in bundles in all the marketplaces. Encircling the bushes, pendent from small trees and shrubs, is a *Lycopodium* with fringed leaves, the fringe turning black when developed into spores; the edges of the young leaves are entire. It is found from this lake to 3500 feet alt., 40 miles from the capital. A wild Raspberry spreads over acres of land near the lake, and lines the path in all moist parts of the journey till approaching the capital, and the dry red soil 40 miles south of it. Both leaves and fruit are used as medicine, bruised and mixed with rice-water, emollient and expectorant.

The canal leads to the first village on the ascent, Maromby, the land round about which is constantly moist, almost alluvial. Abundance of rice is grown. Near this village were copses of *Vangueria*, and, around it and almost every village stopped at, a *Heliconia*, with pink offshoots or sprouts near the root, which are eaten by the natives. In the canals and pools, here and elsewhere, grows a *Lotus* (*Nymphæa*) with a blue flower; the bulb is in much request by the natives, who prepare from it a kind of sago. After leaving this lake and low district, the road leads over hills, hill rising beyond hill, the land mammillated with them; and truly the cattle seem grazing on a thousand hills. The ravines are filled with the Traveller's Tree, Bananas, and the Rofia Palm (*Sagus Ruffia*). The soil at the bottom of these ravines is very rich, and the vegetation most luxuriant—differing much from that at the highest elevation reached, where, from rockiness of the soil and absence of water, scarcely a plant thrives, and artificial aids are had recourse to, to enable the natives to grow their rice. As we ascend the country, the Rofia grows more abundantly, and the Ravenala less. The sides of valleys, and ultimately the crests of hills, become clothed with dense bush of a Composite tree with orange flowers, and two forms of *Arbutus* (?), both common at the Cape. The rivers crossed for the first 40 miles from the sea had fine-sandy bottoms, subsequently quartz and sand, and quartz and débris of sandstone.

Studding the hills, or standing out in solitary boulders, were masses of sandstone, the exposed surface blackened. The hills are well covered with a coarse grass, growing in tufts, amongst which is found an Apocyneous herb avoided by the cattle (the same as found up the Zambesi). On the second day's journey from the sea, and at about 1500 feet above it, is the village Ranumafain, and below it, running south, the river after which it is named. It is in this river (*Ranu*, water, *mafana*, hot) that the hot springs are found. As the hot current jets from the river-bottom below 2 feet of rapidly flowing spring-water, it is difficult to estimate the temperature by the thermometer. One jet is at a shallow part of the stream, and the heated water which was projected to the surface raised the thermometer at once to 160° Fahr. The foot or hand placed within reach of the jet felt scalded, and was instantly and involuntarily withdrawn. I counted five springs whilst walking across the stream; they are conspicuous by the bubbling of the water from escape of gas. Hearing that former visitors had found some difficulty in procuring the hot water by a jug or bottle, I used a bamboo for the purpose, first making a small hole at one end, which was stopped till the mouth covered well the spot from which the water issued; and I obtained, I believe, a good sample of it. The water had a faint smell, slight alkaline reaction, and insipid taste; a dollar, previously brightened on the sand, being dropped into the bamboo, was found completely blackened on examination two days subsequently.

From this river the country becomes more wooded, and on the third day's journey from the sea we enter the forest, after crossing many streams, and now meet with tree-ferns and several creeping ones. The road continues over tenacious yellow and red clay, studded here and there with quartz; and the river-beds are of sandstone, pebbles, and quartz. Floating in the less rapid streams were sometimes found the flowering stalks of the *Ouvirandra fenestralis*; but it was most abundant in the Ranomafain River, near the hot springs. I may mention that I collected some shells in the hot springs—a species of *Melania*: some were alive, but most dead, probably boiled. In the streams by the coast I saw small specimens of *Pistia stratiotes*, but not after leaving the coast. The Arums continue, and line the river-banks of this part of the country. Conspicuous on the banks of some of the rivers, and seen in many marshes, was a *Crinum* with large white flowers, sweet-scented: native name Kingass. That part of the country in which the woods first passed through are situated has the most prolific vegetation. There is a redundance of lichens, mosses, and ferns—all the older and larger trees being covered with all three. One lichen in particular abounds in every wood, and hangs from most of the larger trees; it resembles the *Roccella fuciformis* of the Zambesi and East Africa. From these woods is obtained some of the timber used in house-building, and brought down to

Tamatave for exportation. Small ebony is found here; but it is from woods more to the north-westward that the best supplies of ebony, teak, and other woods are obtained.

In the shady and moist parts of the woods I found several plants with variegated leaves—a *Coleus* with bright pink markings along the midrib and veins, and a *Sonerila* with silvery intra-marginal markings, another with white spots in row, another with pink dottings and lines. There were four herbs in these woods with beautiful leaves of variegated tints, looking like "sports."

A fine *Calanthe*, with a spike as long as the finest *Angræcum*, is found in the woods north-east of Tamatave.

Having passed the thickest of the woods, a long stretch of hills follows. The soil is still of yellow clay, in many parts bearing evidence of containing iron; it is studded with masses of black basaltic rock. On one of these hills a view is obtained of the sea, distant some 30 miles. It is called "the weeping-place of the Hovas," because in times past, when slaves or offenders were brought down from the capital to be sold at the coast for exportation, it was from the summit of this hill that they saw the sea for the first time, and their native land for the last, the Hova country proper ceasing about 70 miles south of the capital.

The Rofia Palm continues in great abundance; and the hill-sides are covered with Citron-trees and the Composite bush before mentioned.

On the seventh day after leaving the coast we reached high table-land—a plain about 8 miles broad, said to extend in a north-west direction between 30 and 40 miles; it is bounded on the west by a ridge of mountains running north and south. There are several marshes and little lakes in the hollows, and much wild fowl. The grass is abundant, but coarse. Having passed the plain, the largest river crossed during the journey is met with: this is the Mangoro, about 90 yards wide, with a current equal to about two knots. Thirty miles below the part we crossed, it forms fine cataracts. It flows into the sea about 150 miles south of Tamatave. After crossing the river, more hills have to be ascended, the surface of which is composed of yellow clay; but a landslip near the river exposed three strata below this,—1st, a red clay, mixed with shining particles of what appeared like sedimentary sandstone; 2ndly, beneath this a red earth like lateritious detritus; and 3rdly, below these, and penetrating through them, lava-like honeycombed masses.

On these hills the Heath first seen near the sea is again met with, and for five or six miles nothing else is seen. But at the close of the day's journey we passed through a fine valley, well watered, with numerous villages and a large Hova population. There is now a decided change in the character of the country, houses, and people. In place of the undulating small hills, there is a single range of huge mountains. The houses, hitherto with but a single room, have now several, and are two-storied and built of planking, with sides of a composition (baked clay, &c.), and thatched with papyrus; whilst those previously passed have been either of rofia for sides and roof, or of split bamboo for the sides and a grass or rofia covering. This style of house continues to the capital. The clay used in some places is of a bluish colour. The inhabitants are all Hova, with their long black hair, ample lamba, and taciturn disposition and love of money.

Leaving them, there are but 40 miles to be passed to reach the capital; and the nearer it is approached, the less is the vegetation. The road at first lies through woods, with small timber; but after leaving these, it is over rugged hills of stiff red and yellow clay, protruding through which are massive boulders of granite. The largest village passed is almost built on the slabs of granite that pave the hill. The ravines are no longer filled with Rofia and shrubs, though the Rofia continues, and is found in gardens near the capital. Every available piece of good soil at the bottom of the ravines is carefully tended and manured for raising rice; and every little spring is diverted in many directions, to irrigate these little paddy-patches.

In the moist parts of the road a few shrubs are found; and the *Buddleia*, first met with on the sixth day from the sea, flourishes in profusion. A dwarf Heath clothes some of the most rugged of the rocks and hills, and a few of the ferns before met with are found in moist and secluded situations.

The hills close by the capital are perfectly bare; and there is but one conspicuous flower on which the eye can rest: this is Sunga-sunga of the natives (*Euphorbia fulgens*), of which there are two varieties, one a bright vermilion, the other bright orange. It grows from a thorny little plant, which creeps along the mud walls of the path, or those raised to enclose rice-grounds. It has an abundance of milky juice.

And this, Sir, is all my scanty knowledge of botany will allow me to say of the features of the road.

Mr. Ellis's description and sketch of the town (Antananarivo) give one no idea of its extent. It is built on the four sides of a hump-shaped hill; the houses rise tier over tier, each house enclosed in its square of mud or stone wall; and the whole town surmounted by the great white palace, and that again by the big bronze eagle and the national flag. It is difficult to estimate the population; an old resident said 70,000, others 100,000 and 150,000. It is densely populated. We found that the King's coronation was put off till the 23rd of September.

The seasons of Madagascar and the Zambesi country seem almost identical. The bad season in both is between November and March. The difference in the fever seems to be, that that of the Zambesi, from being at first a sthenic intermittent, resolves into remittent; that of the Malagasy is intermittent, with the stages irregular, and persisting in periodic return until full perspiration has been excited. The Embassy passed through the country during the healthiest time, and we had no fever; nor is there any heard of after leaving the coast, except at very marshy and naturally unhealthy situations. Antananarivo, though ill-drained, is healthy all the year round. The climate of the whole road was to all of us most bracing and invigorating. The maximum of the thermometer was 88° (at noon), and minimum 49° (between 4 and 6 A.M.), being almost the same as that observed last year (August) when I was at the Mission station at Magomero, Shiré River.

There are few diseases amongst the Malagasy. Small-pox is common, but seldom destroys, insomuch that the people refuse to be vaccinated, having little fear of it. There are several skin-diseases. Eczema and impetigo are very common. I saw a few cases of lepra, and two of elephantiasis. The skin-diseases are very bad. There is only one medicine used for them—the Menerara; and it seems to do good in some cases, especially the ulcerated. I think some forms of skin-diseases must be mistaken for syphilitic eruption, as I found far less evidence of the universal existence of this disease than I was led to suppose, though some of the cases seen were frightful; but then it must be recollected they have no remedies to check its ravages.

Believe me to be very faithfully yours,

CHARLES MELLER.

# On a presumed case of Parthenogenesis in a Species of *Aberia*. By T. ANDERSON, M.D., F.L.S., Officiating Superintendent of the Calcutta Botanic Gardens.

[Read January 15, 1863.]

Two thorny bushes, supposed to be the Kei Apple of South Africa, and provisionally referred to *Diospyros*, have been for some years in the Botanic Gardens, Calcutta, without producing flowers. A few months after I received charge of the Botanic Gardens, in March 1861, the largest plant bore a large crop of well-ripened fruits, though only pistilliferous flowers could be detected at the time of flowering, the species being diœcious. The seeds obtained from these fruits were sown, and there is now a vigorous stock of young plants. In February 1862 the same plant flowered; and from the opening of the first flower-bud until the last withered flower dropped off, not a day passed without a careful examination being made by me for the traces of a stamen in the flowers, but without finding one. The plant continued in flower for nearly a month, but produced only pistilliferous flowers. Many of the ovaries became enlarged to the size of peas, and a corresponding increase took place in the ovules; but all ultimately fell off the tree. This tree was unfortunately destroyed a few months ago, in a very severe gale. The second specimen has not yet flowered; it was artificially propagated from the original plant, now lost, and is therefore pistilliferous. Before I saw the flowers, I despatched specimens of the fruit to Sir W. Hooker for the Museum at Kew. Dr. Hooker recognized the fruit as belonging to Hochstetter's genus *Aberia*; and my examination of the flowers confirms this identification*. The plant does not occur in Harvey & Sonder's 'Flora Capensis,' though these botanists describe two species of *Aberia* from South Africa†. I can find no account, among the records in my possession, of the introduction of the plant into the

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* That portion of the generic description referring to the number of the styles and the cells of the ovary must be altered to include this species. The number of styles in the other species is 2–3, and of the cells of the ovary 1–3, but usually 2. In *Aberia edulis* both the styles and the cells of the ovary are from 6–8 in number.

† [This species is described, in the Addenda to the 2nd volume of the 'Flora Capensis,' as *A. Caffra*.—J. D. H.]

Calcutta Botanic Gardens. I have added a description of the plant.

ABERIA CAFFRA, *Hook. f. & Harv. in Fl. Cap.* ii. *Addend.* 584. Fruticosa, ramis strictis, spinis rigidis patentibus armatis, spinis longissimis, acutis; foliis petiolatis, ovatis, ovato-oblongis, basi attenuatis, apice obtusis, emarginatis, margine integris, glabris, coriaceis, paucinerviis; floribus fœmineis solitariis, pedunculatis, in ramulis abbreviatis 4–5 confertis; calyce 5–8-partito, plerumque 7-partito, persistente, petalis et staminibus nullis; ovario globoso, glabro, 6- vel 7-locularis, rare 8-locularis; stylis 6–8, divergentibus, minute puberulis; fructu globoso, glabro, carnoso, seminibus ovatis, compressis.

*Hab.* In horto botanico Calcuttensi, ex Africa australi, culta.

*Frutex* 15-20-pedalis. *Cortex* cinereus, glaber. *Rami* striati, spinosi. *Spinæ* axillares, patentes, rigidæ, 1½–3 unc. longæ. *Folia* in virgis, alterna, in ramis veteribus fasciculatis, 1–2 unc. longa, ½–1¼ unc. lata, petiolo ¼–½ unc. longo. *Flores masculi* ignoti; *fœminei* glabri, pallide virides, parvi, pedunculo glabro, fere ½ unc. longo. *Fructus* pomum parvum in magnitudine æquans, basi calyce persistente cinctus; cortice flavo; succo flavo, sublacteo, in usu grato.

## On a new *Heliconia* with the habits of a *Musa*, sent from New Granada by Dr. A. ANTHOINE to the Royal Gardens, Kew. By J. D. HOOKER, M.D., F.R.S. & L.S.

[Read January 15, 1863.]

THIS very remarkable plant was first brought under my notice by P. Le Neve Foster, Esq., Secretary of the Society of Arts, who received a sketch of it from Dr. Anthoine of Carthagena, with some account of the fibre its peduncles produce. Mr. Foster put me in communication with Dr. Anthoine, who exerted himself at once in procuring dried specimens and seeds for the Royal Gardens of Kew. The former consist of three perfect spikes, and some flowers dried for examination, which, with his sketch and notes, have enabled me to draw up the following description:—

The habit, size, and general appearance of this noble plant are those of a *Musa*, the trunk, which attains 12–16 feet in height, being formed by the vaginæ of the leaves. The peduncles project far beyond the leaves, and, curving downwards, bear a large, narrow, flattened spike, 2½ feet long, something resembling the tail-rattle of the rattlesnake on a gigantic scale. The structure of the flower and fruit accords perfectly with that of other *Heliconiæ*, but these organs are almost concealed by the spathe and bracts. Its nearest known ally is probably *H. rostrata*, Ruiz and Pavon, a native of Peru. Dr. Anthoine desires that this noble plant should bear the name of the Empress of Russia, which I have therefore attached to it.

HELICONIA MARIÆ, *Hook. f.* Foliorum vaginis truncum elatum efformantibus, lamina oblonga petiolata ampla, spicis longe pedunculatis pendulis, spathis crebre dense disticho-imbricatis rachin omnino velantibus late ovato-cymbiformibus recurvis obtusis, floribus bracteis inclusis glabratis.

*Hab.* Betami on the Sinu River (lat. 8° N.), State of Bolivar, in New Granada (*Dr. A. Anthoine*).

*Truncus* 3–4 metr., cum foliis 6 metr., etiam 10–15 centimetr., lævis, viridi-purpureus (*Anth.*). *Folia* oblonga v. lineari-oblonga, obtusa, 3–4 ped. longa, petiolo æquilonga, viridia. *Pedunculus* crass. digiti, curvus, glaber, siccus flexuosus, teres, intus vasibus mollibus farctus. *Spicæ* 1½ ped. longæ, 3–4 poll. latæ, lineares, obtusæ, compressæ. *Spathæ* 60–80, dense imbricatæ, reflexæ, valde concavæ, late ovato-cymbiformes, glabræ v. pubescentes, lateribus erectis, basin versus subcordatæ, marginibus undulatis, apice obtusiusculæ; infimæ rostratæ; inferiores 1–2 distantes, 4–5 unc. longæ, rachin pubescentem non tegentibus; cæteræ 2–2½ unc. longæ, rachin velantes; superiores inferiores amplectentes. *Flores* rubri (*Anth.*), in spatha singula 15–20, bracteis lineari-lanceolatis glabriusculis inclusi, receptaculo brevissimo in axilla spathæ inserti; apicibus perianthii tantum exsertis. *Bracteæ* albæ, spatha breviores, ovato-lanceolatæ, basi concavæ, exteriores vacuæ. *Pedicelli* ½″ longi, crassiusculi, villosuli, compressi. *Ovarium* trigonum. *Perianthium* 1″ long., foliolis extus subtomentosis. *Stylus* apice incurvus. *Antheræ* inclusæ. *Drupa* cærulea (*Anth.*), 3-cocca; coccis oblongis, compressis, basi antice fovea cupulæformi notatis, subrugosis, osseis, intus subrugosis. *Semen* erectum; testa membranacea, raphe annulari circumdata. *Albumen* subfarinaceum. *Embryo* axillaris, gracilis, extremitate radiculari paulo crassiore, germinatione foveam cocci perforante.

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## On the existence of two forms, and on their reciprocal sexual relation, in several species of the genus *Linum*. By CHARLES DARWIN, M.A., F.R.S., F.L.S., &c.

[Read February 5, 1863.]

THE crimson *Linum grandiflorum* presents two forms, occurring in about equal numbers, which differ little in structure, but greatly in function. The foliage, corolla, stamens, and pollen (examined dry, and distended with water) are alike in both forms. The difference is confined to the pistil: in the one form, which I will call "short-styled," the column formed by the united styles, and the short stigmas, together is about half the length of the whole pistil in the other and "long-styled" form. A more important distinction is, that the five stigmas in the short-styled form diverge greatly from each other and pass out between the filaments of the stamens, and thus lie within the tube of the corolla. In the long-styled form the elongated stigmas stand nearly upright, and alternate with the anthers. In this latter form the length of the stigmas varies considerably, their upper extremities projecting even a little above the anthers, or reaching up only to about their middle. Nevertheless there is never the slightest difficulty in distinguishing between the two forms; for, besides the difference in divergence, the stigmas of the short-styled form never reach even to the bases of the anthers. In the short-styled, the papillæ on the stigmatic surfaces are shorter, darker-coloured, and more crowded together than in the long-styled form: but these differences seem due merely to the shortening of the stigma; for in the varieties of the long-styled form with shorter stigmas, the papillæ are more crowded and darker-coloured than in those with the longer stigmas. Considering the slight and variable differences between the two forms of this *Linum*, it is not surprising that they have been hitherto overlooked.

In 1861 I had eleven plants growing in my garden, eight of which were long-styled, and only three short-styled. Two very fine long-styled plants grew in a bed a hundred yards off, and separated from the others by a screen of evergreens. I marked twelve flowers, and put on their stigmas a little pollen from the short-styled plants. The pollen of the two forms is, as stated, identical in appearance; the stigmas of the long-styled flowers were already thickly covered with their own pollen—so thickly that I could not find one bare stigma; and it was late in the season, namely, September 15th. Altogether, to expect any result from this trial seemed almost childish. From my experiments, however, on *Primula*, which have been laid before this Society ('Journal,' vol. vi. p. 77), I had faith, and did not hesitate to make the trial, but certainly I did not anticipate the full result. The germens of these twelve flowers all swelled, and ultimately six fine capsules (the seed of which germinated this year) and two poor capsules were produced; only four capsules shanked off. These two plants produced, before and after and at the time of the trial, a vast number of flowers, but the germens of not even one swelled. All these flowers, though their stigmas were so densely covered with their own pollen, were absolutely barren.

The nine other plants, six long-styled and three short-styled, grew in the beds of the same flower-garden. Four of the long-styled produced no seed-capsules; one produced two; but the remaining long-styled plant grew so close to a short-styled plant that their branches touched, and this produced twelve capsules, but they were poor. The case was different with the short-styled plants. The plant which grew in juxtaposition with the long-styled plant produced ninety-four imperfectly fertilized capsules containing a multitude of bad seeds, with a moderate number of good seeds. The two other short-styled plants grew in a single clump, and were very small, being partly smothered by other plants; they did not stand very close to any long-styled plants, yet they yielded together nineteen capsules. These facts seem to show that the short-styled plants are far more fertile with their own pollen than the long-styled. We shall immediately see that this is the case in a slight degree. But I suspect that in this instance the difference in fertility between the two forms was in part due to a distinct cause. I repeatedly watched the flowers, and only once saw a humble-bee momentarily alight on one, and then fly away, as if it were not to its taste. If bees had visited the several plants, there cannot be a doubt that the four long-styled plants which did not produce a single capsule would have borne an abundance. But several times I saw small diptera sucking the flowers; and these insects, though not visiting the flowers with anything like the regularity of bees, would carry a little pollen from one form to the other, especially when growing close together; and the stigmas of the short-styled plants, diverging within the tube of the corolla, would be more likely than the upright stigmas of the long-styled to receive a small quantity of pollen when brought by small insects. From the much greater number of long-styled than of short-styled flowers in the garden, evidently the short-styled would be more likely to receive some pollen from the long-styled, than the long-styled from the short-styled.

In 1862 I raised thirty-four plants of this *Linum* in a hotbed; and these consisted of seventeen long-styled and seventeen short-styled forms. Seed sown later in the flower-garden yielded seventeen long-styled and twelve short-styled forms. These facts justify the statement that the two forms are produced in about equal numbers. The first thirty-four plants were kept under a net which excluded insects. I fertilized heteromorphically fourteen long-styled flowers with pollen from the short-styled, and got eleven fine seed-capsules; these contained on an average 8·6 seeds per capsule, but only 5·6 were apparently good. It may be well to state that ten seeds is the maximum possible production for a capsule, and that our climate cannot be very favourable to this North-African plant. On three occasions I fertilized homomorphically the stigmas of altogether nearly a hundred flowers (but did not separately mark them) with their own pollen, but taken from separate plants, so as to prevent any possible ill effects from close interbreeding; and many other flowers were produced, which, as before stated, would get plenty of their own individual pollen; yet from all these flowers, borne by the seventeen long-styled plants, only three capsules were produced; one of these included no seed, and the other two together gave only five good seeds. Nor do I feel at all sure that this miserable product of the two half-fertile capsules from the seventeen plants, each of which must have produced at least fifty or sixty flowers, is really the result of their fertilization by their own pollen; for I made a great mistake in keeping the two forms under the same net, with their branches often interlocking, and it is surprising that a greater number of flowers were not accidentally fertilized.

Of the short-styled flowers I fertilized heteromorphically twelve with the pollen of the long-styled (and to make sure of the result I previously castrated the majority), and obtained seven fine seed-capsules. These included an average of 7·6 seeds, but of apparently good seed only 4·3 per capsule. At three separate times I fertilized homomorphically nearly a hundred flowers with their own-form pollen, taken from separate plants; and numerous other flowers were produced, many of which must have received their own pollen. From all these flowers borne on the seventeen plants, only fifteen capsules were produced, of which only eleven contained any good seed, on an average 4·2 per capsule. As remarked in the case of the long-styled plants, some even of these capsules were perhaps the product of a little pollen accidentally fallen from the flowers of the other form. Nevertheless the short-styled plants seem to be slightly more fertile with their own pollen, in the proportion of fifteen capsules to three, than the long-styled: the real proportional excess in fertility is probably a little greater, as the short-styled flowers, when not disturbed, do not so surely receive their own pollen as do the long-styled. The greater self-fertility of the short-styled flowers was, as we have seen, also shown by the plants left to themselves, and but sparingly visited by insects, in the flower-garden in 1861, and likewise by those raised in 1862.

The absolute sterility (judging from the experiments of 1861, and which is hardly contradicted by those of 1862) of the long-styled plants with their own-form pollen led me to examine into its apparent cause; and the result is so curious that it will be worth while to give most of the experiments in detail. These experiments were tried on fresh plants, grown in pots and brought successively into the house.

*First.* I placed pollen from a short-styled flower on the five stigmas of a long-styled plant, and after thirty hours found them deeply penetrated by a multitude of pollen-tubes, far too numerous to be counted; the stigmas had become discoloured and twisted. I repeated this experiment on another flower, and in 18 hours found the stigmas penetrated by a multitude of long pollen-tubes. All this is what might have been expected, as this is a fertile or heteromorphic union. I likewise tried the converse experiment, and placed pollen from a long-styled flower on the stigmas of a short-styled flower, and in 24 hours found the stigmas discoloured, twisted, and penetrated by numerous pollen-tubes; and this, again, is what might have been expected, as this is a fertile or heteromorphic union.

*Secondly.* I placed pollen of a long-styled flower on all five stigmas of a long-styled flower on a separate plant: after 19 hours I rigorously dissected the stigmas, and found only a single pollen-grain which had emitted a very short tube. To make sure that the pollen was good, I took in this case, and in most other cases, pollen either from actually the same anther or from the same flower, and proved it to be good by placing it on the stigma of a short-styled plant, and seeing numerous pollen-tubes emitted.

*Thirdly.* Repeated last experiment, and placed own-form pollen on all five stigmas of a long-styled flower; and, after 19½ hours, not one single grain had emitted its tube.

*Fourthly.* Repeated the experiment, with the same result after 24 hours.

*Fifthly.* Repeated last experiment, and, after leaving pollen on for 19 hours, put an additional quantity of own-form pollen on all five stigmas. After an interval of exactly three whole days, I rigorously examined the stigmas, which, instead of being discoloured and twisted, were straight and fresh-coloured; and only one grain had emitted quite a short tube, which could be drawn out of the stigmatic tissue without being ruptured.

The following experiments are more striking:—

*Sixthly.* I placed own-form pollen on three of the stigmas of a long-styled flower, and pollen from a short-styled flower on the other two stigmas. After 22 hours these two stigmas were discoloured, and slightly twisted, and penetrated by the tubes of numerous pollen-grains: the other three stigmas, covered with their own-form pollen, were fresh, and all the pollen-grains were loose; but I did not dissect the whole stigma rigorously.

*Seventhly.* Experiment repeated in the same manner, with the same result.

*Eighthly.* Experiment repeated, but the stigmas were carefully examined after an interval of only 5½ hours. The two stigmas with pollen from a short-styled flower were penetrated by innumerable tubes; but these were as yet short, and the stigmas themselves were not at all discoloured. The three stigmas covered with their own-form pollen were not penetrated by a single pollen-tube.

*Ninthly.* Put pollen of short-styled on one stigma, and own-form pollen on the other four stigmas; after 24 hours, found the one stigma somewhat discoloured, and twisted, and penetrated by many long tubes: the other four stigmas were quite straight and fresh; but on dissecting their whole lengths I found that three pollen-grains had protruded quite short tubes into the tissue.

*Tenthly.* Repeated the experiment, with the same result after 24 hours, excepting that only two own-form grains had penetrated the stigmatic tissue with their tubes, to a very short depth: the one stigma, which was deeply penetrated by a multitude of tubes from the short-styled pollen, presented a conspicuous difference in comparison with the other four straight and bright pink stigmas, in being much curled, half-shrivelled, and discoloured.

I could add a few other experiments; but those now given amply suffice to show that the pollen-grains of a short-styled flower placed on the stigmas of a long-styled flower emit a multitude of tubes after an interval of from five to six hours, and penetrate the tissue ultimately to a great depth, and that after twenty-four hours the stigmas thus penetrated change colour, become twisted, and appear half-withered. On the other hand, the pollen-grains of the long-styled flowers placed on their own stigmas, after an interval of a day, or even three days, do not emit their tubes, or at most only three or four grains out of a multitude emit their tubes; and these apparently never penetrate the stigmatic tissue deeply, and the stigmas themselves do not become discoloured and twisted.

This seems to me a remarkable physiological fact. The pollen-grains of the two forms are undistinguishable under the microscope; the stigmas differ only in length, degree of divergence, and in the size, shade of colour, and approximation of their papillæ, these latter differences being variable and apparently simply due to the elongation of the stigma. Yet we plainly see that the two pollens and the two stigmas are widely dissimilar in action—the stigmas of each form being almost powerless on their own pollen, but causing, through some mysterious influence, by simple contact (for I could detect no viscid secretion), the pollen-grains of the opposite form to protrude their tubes. It may be said that the two pollens and the two stigmas by some means mutually recognize each other. Taking fertility as the criterion of distinctness, it is no exaggeration to say that the pollen of the long-styled *Linum grandiflorum* (and conversely of the other form) has been differentiated, with respect to the stigmas of all the flowers of the same form, to a degree corresponding with that of distinct species of the same genus, or even of species of distinct genera.

*Linum perenne.*—The dimorphism is here more conspicuous, and has been noticed by several authors. In the long-styled form the pistil is nearly twice as long as in short-styled; in the latter the stigmas are smaller and, diverging more, pass out between the filaments of the stamens. I could detect no difference in the size of the stigmatic papillæ; in the long-styled form alone the stigmatic surfaces turn round so as to face the circumference of the flower: but to this point we shall presently return. Differently from what occurs in *L. grandiflorum*, the long-styled flowers have stamens hardly more than half the length of those of the short-styled. The size of the pollen-grains is rather variable; after some doubt, I have come to the conclusion that there is no uniform difference between the pollen of the two forms. The long stamens in the short-styled form project to some height above the corolla, and, apparently from exposure to the light, the filaments are coloured blue. These longer stamens correspond in height with the lower part of the stigmas of the long-styled flowers; and the shorter stamens of the latter form correspond in the same manner in height with the shorter stigmas of the short-styled flowers.

I raised from seed twenty-six plants, which proved to be twelve long-styled and fourteen short-styled. They flowered well, but were not large plants. As I did not expect them to flower so soon, I did not transplant them, and they unfortunately grew with their branches closely interlocked. All the plants were covered by a net, excepting one of each form. First, of the long-styled flowers, twelve were homomorphically fertilized by their own-form pollen, taken in every case from a separate plant; and not one flower set a seed-capsule: twelve other flowers were heteromorphically fertilized by pollen from short-styled flowers; and they set nine pods, each including on an average seven good seeds: as before, ten seeds is the maximum possible production. Secondly, of the short-styled flowers, twelve were homomorphically fertilized by own-form pollen, and they yielded one capsule, including only three good seeds; twelve other flowers were heteromorphically fertilized by pollen of long-styled flowers, and these produced nine capsules, but one was bad; the eight good capsules contained on an average exactly eight good seeds each.

The many flowers on the eleven long-styled plants under the net, which were not fertilized, produced only three capsules (including 8, 4, and 1 good seeds); whether, owing to the interlocking of the branches, these accidentally received pollen from the other form, I will not pretend to conjecture. The single long-styled plant which was uncovered, and grew close by the uncovered short-styled plant, produced five good pods; but it was a very poor and small plant.

The flowers borne on the thirteen short-styled plants under the net, which were not fertilized, produced twelve capsules (containing 5·6 seeds on average): as some of these capsules were very fine, and five were borne on one twig, I suspect that they had been visited by some minute insect which had accidentally got under the net and had carried pollen from the other form. The one uncovered short-styled plant yielded exactly the same number of capsules, namely, twelve.

From these facts we have some evidence, as in the case of *L. grandiflorum*, that the short-styled plants are in a very slight degree more fertile with their own pollen than are the long-styled plants. And we have the clearest evidence, from the result of the forty-eight flowers artificially fertilized, that the stigmas of each form require pollen from the stamens of corresponding height produced by the opposite form.

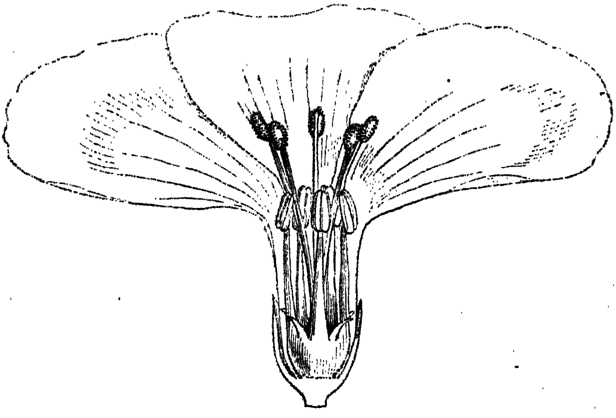
In contrast with the case of *L. grandiflorum*, it is a singular fact that the pollen-grains of both forms of *L. perenne* when placed on their own-form stigmas, though not causing fertility, yet emit their tubes; and these tubes I found, after an interval of eighteen hours, had penetrated the stigmatic tissue, but to what depth I did not ascertain. In this case the inaction of the pollen-grains on their own stigmas must be due either to the tubes not reaching the ovules, or reaching them and not efficiently acting on them. In the case of *Lythrum Salicaria,* which I hope at some future time to lay before the Society, there are three distinct forms, each of which produces two kinds of pollen; but neither pollen, when placed on its own stigma, causes fertility, except occasionally and in a very moderate degree; yet the pollen-tubes in each case freely penetrate the stigmatic tissue.

The plants of *L. perenne* and of *L. grandiflorum* grew, as stated, with their branches interlocked, and with scores of flowers of the two forms close together; they were covered by an open net, through which the wind, when high, passed; and such minute insects as *Thrips* could not, of course, be excluded; yet we have seen that the utmost possible amount of accidental fertilization on seventeen long-styled plants in the one case, and on eleven plants in the other case, was the production, in each, of three poor capsules; so that we may infer that, when the proper insects are excluded, the wind does hardly anything in the way of carrying pollen from plant to plant. I allude to this fact because botanists, in speaking of the fertilization of plants or of the production of hybrids, often refer to the wind or to insects as if the alternative were indifferent. This view, according to my experience, is entirely erroneous. When the wind is the agent in carrying pollen, either from one separated sex to the other, or from hermaphrodite to hermaphrodite (which latter case seems to be almost equally important for the ultimate welfare of the species, though occurring perhaps only at long intervals of time), we can recognize structure as manifestly adapted to the action of the wind as to that of insects when they are the carriers. We see adaptation to the wind in the incoherence of the pollen, in the inordinate quantity produced (as in the Coniferæ, Spinage, &c.), in the dangling anthers well fitted to shake out the pollen, in the absence or small size of the perianth or in the protrusion of the stigmas at the period of fertilization, in the flowers being produced before they are hidden by the leaves, in the stigmas being downy or plumose (as in the Gramineæ, Docks, and other plants) so as to secure the chance-blown grains. In plants which are fertilized by the wind, the flowers do not secrete nectar, their pollen is too incoherent to be easily collected by insects, they have not bright-coloured corollas to serve as guides, and they are not, as far as I have seen, visited by insects. When insects are the agents of fertilization (and this is incomparably the more frequent case both with plants having separated sexes and with hermaphrodites), the wind plays no part, but we see an endless number of adaptations to ensure the safe transport of the pollen by the living workers. We can recognize these adaptations most easily in irregular flowers; but they do not the less occur in perfectly regular flowers, of which those of *Linum* offer an instance, as I will almost immediately endeavour to show.

I have already alluded to the rotation of each separate stigma in the long-styled form alone of *Linum perenne*. In the other species examined by me, and in both forms when the species are dimorphic, the stigmatic surfaces face the centre of the flower, and the furrowed backs of the stigmas, to which the styles are attached, face the circumference. This is the case, in the bud, with the stigmas of the long-styled flowers of *L. perenne*. But by the time the flower in this form has expanded, the five stigmas, by the torsion of that part of the style which lies beneath the stigma, twist round and face the circumference. I should state that the five stigmas do not always perfectly turn round, two or three often facing only obliquely towards the circumference. My observations were made during October; and it is not improbable that earlier in the season the torsion would have been more perfect; for after two or three cold and wet days the movement was very incomplete. The flowers should be examined shortly after their expansion; for their duration is brief, and, as soon as they begin to wither, the styles become spirally twisted together, and the original position of the parts is lost.

He who will compare the structure of the whole flower in both forms of *L. perenne* and *grandiflorum*, and, I may add, of *L. flavum*, will, I think, entertain no doubt about the meaning of this torsion of the styles in the one form alone of *L. perenne*, as well as the meaning of the divergence of the stigmas in the short-styled forms of all three species. It is absolutely necessary, as we now know, that insects should reciprocally carry pollen from the flowers of the one form to those of the other. Insects are attracted by five drops of nectar, secreted exteriorly at the base of the stamens, so that to reach these drops they must insert their proboscides outside the ring of broad filaments, between them and the petals. In the short-styled form of the above three species, the stigmas face the axis of the flower; and had the styles retained their original upright and central position, not only would the stigmas have presented their backs to insects as they sucked the flowers, but they would have been separated from them by the ring of broad filaments, and could never have been fertilized. As it is, the styles diverge greatly and pass out between the filaments. The stigmas, being short, lie within the tube of the corolla; and their papillous faces, after the divergence of the styles, being turned upwards are necessarily brushed by every entering insect, and thus receive the required pollen.

In the long-styled form of *L. grandiflorum*, the parallel anthers and stigmas, slightly diverging from the axis of the flower, project only a little above the tube of the somewhat concave corolla; and they stand directly over the open space leading to the drops of nectar. Consequently when insects visit the flowers of either form (for the stamens in this species occupy the same position in both forms), they will get their proboscides well dusted with the coherent pollen. As soon as the insect inserts its proboscis to a little depth into the flower of the long-styled form, it will necessarily leave pollen on the faces and margins of the long stigmas; and as soon as the insect inserts its proboscis to a rather greater depth into the short-styled flowers, it will leave pollen on their upturned stigmatic surfaces. Thus the stigmas of both forms will indifferently receive the pollen of both forms; but we know that the pollen alone of the opposite form will produce any effect and cause fertilization.



Long-styled form of *L. perenne*, var. *Austriacum*, with the petals and calyx removed on the near side.

In the case of *L. perenne*, affairs are arranged a little more perfectly; for the stamens in the two forms stand at different heights, and pollen will adhere to different parts of an insect's body, and will generally be brushed off by the stigmas of corresponding height, to which stigmas each kind of pollen is adapted. In this species, the corolla is flatter, and in the one form the stigmas and in the other form the anthers stand at some height above the mouth of the corolla*. These longer stigmas and longer stamens do not diverge greatly; hence insects, especially rather small ones, will not insert their proboscides between the stigmas or between the anthers, but will strike against them, at nearly right angles, with the backs of their head or thorax. Now, in the long-styled flowers of *L. perenne*, if each stigma had not rotated on its axis, insects in visiting them would have struck their heads against the backs of the stigmas; as it is, they strike against the papillous fronts of the stigmas, and, their heads being already charged with the proper coherent pollen from the stamens of corresponding height borne by the flowers of the other form, fertilization is perfectly effected.

Thus we can understand the meaning of the torsion of the styles in the long-styled flowers alone, as well as their divergence in the short-styled flowers.

One other point is worth a passing notice. In botanical works many flowers are said to be fertilized in the bud. This rests solely, as far as I can discover, on the anthers opening in the bud; no evidence is adduced that the stigma is at this period mature, or that, if then penetrated by pollen-tubes, it is not subsequently, after the expansion of the flower, acted on by pollen brought from other flowers. In the case of *Cephalanthera grandiflora* I have shown† by experiment that insufficient precocious self-fertilization, together with subsequent full fertilization, is the regular course of events. The belief that flowers of any plant are habitually fertilized in the bud, or are perpetually self-fertilized, is a most effectual bar to really understanding their structure. I am far from wishing to say that some flowers, in certain seasons, are not fertilized in the bud: I have reason to believe that some flowers are frequently fertilized without expanding; but my observations lead me to disbelieve that this is ever the invariable course with all the flowers of any species whatever. As it is difficult to prove without troublesome experiments the falsity of the belief of regular fertilization in the bud, I here notice this subject. An estimable and laborious observer*, resting his belief on the usual kind of evidence, states that in *L. Austriacum* (which is dimorphic and is considered by Planchon as a variety of *L. perenne*) the anthers open the evening before the expansion of the flowers, and that the long-styled stigmas are then almost always fertilized. He asks whether this precocious fertilization in the several species of *Linum* and in other plants is not one cause of the short duration of their flowers. Now we know positively that, so far from *Linum perenne* being fertilized by its own pollen in the bud, its own pollen is as powerless on the stigma as so much inorganic dust.

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* I neglected to get drawings made from fresh flowers of the two forms. Mr. Fitch has made the above sketch of a long-styled flower from dried specimens and published engravings: his well-known skill ensures accuracy in the proportional size of the parts; and I believe their relative position is true.

† Fertilization of Orchids, p. 108.

*Linum flavum.*—To recur to our more immediate subject, in the long-styled form of this species the pistil is nearly twice as long as in the short-styled form; and the stigmas are longer with the papillæ coarser. In the short-styled form the stigmas diverge and pass out between the filaments. The stamens in the two forms differ in height, and, what is singular, the anthers of the longer stamens are shorter; so that in the short-styled form both stigmas and anthers are shorter than in the other form. The pollen of the two forms does not differ. I have not been able to try any experiments on this species; but a careful observer, Mr. W. C. Crocker, intends proving their reciprocal fertility next summer. As this plant is propagated by cuttings, I have generally found that all the plants in the same garden belong to the same form. On inquiry I have never heard of its seeding in this country; but to anyone wishing to raise seedlings, in all probability the path is now open, namely, by carrying pollen from one form to the other.

I have now shown that three species of *Linum* are dimorphic, besides several races of *L. perenne*, esteemed by some botanists to be distinct species, such as *L. montanum*, *L. Sibiricum*, and *L. Austriacum*. According to Vaucher†, *L. Gallicum*, *L. maritimum*, and *L. strictum* are in the same manner dimorphic, as likewise is, according to Planchon‡, *L. salsoloides*. This latter botanist is the only one who seems to have been struck with the importance of the subject; and he acutely asks whether this dimorphism has not some influence on the manner of fertilization. We thus know of seven dimorphic species of *Linum*; but as this structure has been overlooked in such common garden-flowers as *L. grandiflorum* and *L. flavum*, it is probably of frequent occurrence.

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* Études sur la Géograph. Bot., par Prof. H. Lecoq, 1856, tom. v. p. 325.

† Hist. Physiolog. des Plantes d'Europe, 1841, tom. i. p. 401.

‡ Hooker's London Journ. of Botany, 1848, vol. vii. p. 174.

All the species, however, are certainly not thus characterized. I have examined many specimens of *L. catharticum*, and found in all that the stamens and stigmas were of nearly equal height and the same in all the plants. So, again, I looked, near Torquay, at many flowers of the wild *L. usitatissimum* or *angustifolium* (I know not which), and there was no trace of dimorphism. Again, I raised 111 plants from seed sent me from Kew, incorrectly named *L. Austriacum*; the plants were tall and straight, having a rather different aspect from the wild species seen at Torquay, with extremely fugacious blue flowers: in all these plants the stigmas stood on a level with the anthers or projected a very little above them. I protected the flowers from insects; but every one of the 111 plants produced plenty of seed. I mention this fact because it had occurred to me that possibly a species might be dimorphic in function, though not in structure.

Lastly, *Linum Lewisii*, which is ranked by Planchon as a variety of *L. perenne*, but which, now that we know the meaning of reciprocal dimorphism, surely deserves specific honours, must not be passed over. According to Planchon*, the same plant bears some flowers with anthers and stigmas of the same height, and others with styles either longer or shorter than the stamens; so that the same individual plant is trimorphic. This, as far as I know, is a unique case. From analogy we may pretty safely predict the function of the three kinds of flowers: those with stigmas and anthers of the same height will be self-fertile; those with these organs of unequal height will require reciprocal fertilization. A plant of *L. grandiflorum* or of the other dimorphic species, growing by itself, could no more perpetuate its race than could one sex of a diœcious plant, nor could any number of plants without the aid of insects. A single plant of *Linum Lewisii*, on the other hand, in all probability could propagate itself, even if no insects were present, as probably sometimes occurs in its Arctic home. If insects visited the plant, the flowers which were dimorphic would be fertile one with another or with those on any neighbouring plant. Thus the plant would receive the advantage of a cross.

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* Hooker's London Journ. of Botany, 1848, vol. vii. p. 175. It is not improbable that the allied genus *Hugonia* is dimorphic; for (p. 525) one species is described "staminibus exsertis;" another has "stamina 5, majora, stylos longe superantia;" and another is furnished "stylis staminibus longioribus."

That this is an advantage, and is one great end gained by reciprocal dimorphism, I can entertain no doubt. That in some cases this dimorphism may be a step towards a complete separation of the sexes, I will not dispute; but good reasons could be assigned to show that there is no necessary connexion between reciprocal dimorphism and a tendency to diœcious structure. Although good is gained by the inevitable crossing of the dimorphic flowers, yet numerous other analogous facts lead me to conclude that some other quite unknown law of nature is here dimly indicated to us.

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## On the Form of the Vascular Fasciculi in certain British Ferns. By Arthur H. Church, B.A. Oxon. Communicated by W. Francis, Ph.D., F.L.S.

[Read Dec. 18, 1862.]

The distribution of the vascular tissues in the stem and stipes of the British species of Ferns has been made the subject of much interesting and accurate study by Dr. Ogilvie*. His papers are to be found in the 'Annals and Magazine of Natural History' for December 1859 and November 1860. My own long-continued examination of the living plants has not enabled me to detect any but the most trivial mistakes in these full and admirable memoirs. I have therefore only to propose a few slight alterations in Dr. Ogilvie's conclusions, and to make one or two additional remarks on certain species and varieties which he omits to notice. The present communication may be deemed the first instalment of such supplementary observations. I may also here state that I

* The following list of papers includes nearly all those in which the vascular tissues of Ferns have been discussed :—

Presl. Tentamen Pteridographiæ. Pragæ: 1836.
Fée. Die Gefässbündel im Stipes der Farne. Pragæ: 1847.
Ogilvie, Dr. Ann. & Mag. Nat. Hist. 1859 and 1860.
Duval-Jouve, J. Etudes sur le Pétiole des Fougères. In Billot's Archives de la Flore de France; pp. 57 & 149.
King. On Sigillaria. Edinburgh Phil. Trans. 1844.
Leighton, Rev. W. A. Hints on a new character in Ferns. Phyt. n. s. i. p. 256.
Moore, T. The Vascular Bundles of the Stipes of Ferns. Phyt. n. s. i. p. 378.
Reichardt, H. W. Ueber der Gefässbündel Vertheilung im Stamme und Stipes der Farne. Denkschriften der Kaiserlichen Akademie der Wissenschaften, xvii$^{ter}$ Band. Wien: 1859.

can confirm the general accuracy of Duval-Jouve's figures so far as they relate to species found in Britain.

To discuss the difficult question of the nomenclature of these plants is beside my purpose; I shall therefore do no more than designate each form named by two or three of its best-known synonyms. At the same time, it seems that the results of such inquiries as the present, as possibly affording criteria of generic if not of specific difference, cannot be wholly disregarded, and may ultimately aid us in arriving at a more consistent classification for the Filices.

The genera *Polystichum* and *Lastrea* as understood by Moore and many other authors are respectively coextensive (so far as our native ferns are concerned) with the genera *Aspidium* and *Nephrodium* adopted by Hooker in his 'British Ferns' (1862). I have examined transverse sections of the stipes of all the generally received species and many of the varieties included under these generic appellations, and in two species only did I find any material departure from that one particular arrangement of the vascular fasciculi which is disclosed by a transverse stipital section of such a form as Moore's *Lastrea Filix-mas* or *Polystichum Lonchitis*. In *Nephrodium Filix-mas*, *N. rigidum*, *N. cristatum*, *N. spinulosum* α. *bipinnatum*, β. *dilatatum*, γ. *æmulum*, δ. *dumetorum*, *Aspidium aculeatum* α. *lobatum*, β. *intermedium*, γ. *angulare* of Hooker, and also in the forms *Lophodium glandulosum*, *L. uliginosum*, *L. nanum*, and *L. collinum* of Newman, the same disposition of the vascular tissue occurs. The two notable exceptions to which I have before alluded are found in *Nephrodium Thelypteris* and *N. Oreopteris* of Hooker, identical with the *Lastrea Thelypteris* and *L. montana* of Moore and the *Hemestheum Thelypteris* and *Lastrea* (*Hemestheum*) *montana* of Newman. In fig. 1 the prevalent arrangement is shown; in fig. 2 that which occurs in the mountain fern; while fig. 3 represents that of the marsh fern, which I will now more particularly describe. In all cases the sections noticed are those of the stipes, not of the stem; and I have freely availed myself of the use of a very weak solution of perchloride of iron, in order that the tracts containing tannin might be distinctly marked out.

*Nephrodium Thelypteris*, Hooker.
*Hemestheum Thelypteris*, Newman.
*Lastrea Thelypteris*, Moore.

The present plant is not only closely connected in many of its external characteristics with *N. Oreopteris*, but also greatly resembles that species in the form and arrangement of the vascular bundles of its stipes. For instance, in a fertile frond, 26 inches long, which I examined, where the stipes measured 12 inches, though the vascular tract could be clearly traced sending a branch of a greenish tint into each pinna, yet there was no sign of the prolongation of the dark sheath so conspicuous in each vascular bundle of the stipes in this fern, and which is an almost invariable element in the other British *Nephrodia* (*Lastreæ*). Now the dark sheath is not partially only, but entirely wanting in *N. Oreopteris*. Figs. 4 *a*, 4 *b*, 4 *c*, and 4 *d* represent transverse stipital sections made respectively at the junction of stem and stipes, and at 3, 6, and 9 inches above that point; figs. 4 *e* and 4 *f*, similar sections at further intervals of 1½ inch. It will be seen that the two large oval vascular bundles have coalesced at 10½ inches from the origin of the stipes, and 1½ inch below the first pair of pinnæ. At and near the origin of the stipes its cortical layer is thick, dense, and dark, as shown in 4 *a*. Above, as the dark sheaths of the fibro-vascular bundles are more marked, and their constituent cells more lignified by secondary deposits, so the cortical layer becomes paler and thinner: this observation has been made frequently with reference to other species of ferns. In figs. 1, 2, & 3, a remarkable difference in the arrangement of the scalariform ducts in the midst of the smaller cells of the fibro-vascular bundles is noticeable. These spiral-fibrous or, rather, scalariform ducts are arranged for the most part, both in *Nephrodium Thelypteris* and in the closely allied species *N. Oreopteris*, in the form of the Greek letter Σ,—the more usual form being that shown in fig. 1, which is, with slight variations, common to all the other British *Nephrodia* and *Aspidia**. Here, all the larger cells of the two main fasciculi† near the axis of the stem are grouped together in an irregular oval or pear-shaped figure, from one extremity of which an incurved prolongation proceeds†. The thickened cells of the cortical layer and of the dark sheath are of nearly equal size, and far less in transverse diameter than the general parenchyma of the stem. They are alike stained black when moistened with perchloride of iron, owing to the presence in them of tannin.

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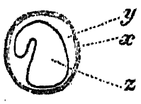
* In the genus *Lastrea*, *L. recurva* (*Fœnisecii*), with its very compound fronds of almost deltoid outline, its dark ramenta, and the trilobed outline displayed by a transverse section of its stipes, passes, by nearly insensible gradations, through *Lastrea dilatata* and its slightly divergent varieties,—through Mr. Westcombe's new form *L. Scotica*,—through the forms *L. glandulosa*, *L. spinulosa*, and *L. uliginosa*, to *L. cristata* with its simpler narrow fronds, its pale concolorous ramenta, and its quadrangular section,—the disposition of the vascular fasciculi remaining nevertheless nearly identical in the whole series.

† In the British Lastreas, &c. (excepting, of course, *L. Oreopteris* and *L. Thelypteris*), the *number* of the fasciculi, though never less than three, is by no means a constant character, sometimes as many as eleven or thirteen being found in a large and vigorous frond. Frequent branching and anastomosing of the

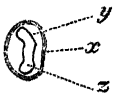
Fig. 1.



× 5.

Transverse section of one of the two larger vascular fasciculi of the stipes of *Nephrodium Filix-mas* (var. *Borreri*).

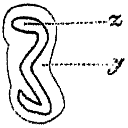
Fig. 2.



× 5.

Transverse section of one of the two fasciculi of the stipes of *N. Thelypteris.*

Fig. 3.

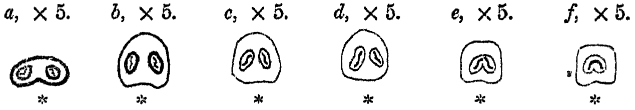


× 5.

Transverse section of one of the two fasciculi of the stipes of *N. Oreopteris.*

The perchloride of iron, as a general rule, darkens the cortical layers and the immediate envelope of the central scalariform vessels.

Fig. 4.



*Nephrodium Oreopteris*, Hooker.
*Hemestheum montanum*, Newman.
*Lastrea Oreopteris*, Moore.

Dr. Ogilvie states that *N. Oreopteris* has two vascular bundles in its stipes, and that there is a tract of dark tissue upon that aspect of each bundle which looks towards the axis of the stipes. I have dissected numerous large and mature specimens of this fern, but have never been able to discover a trace of dark tissue

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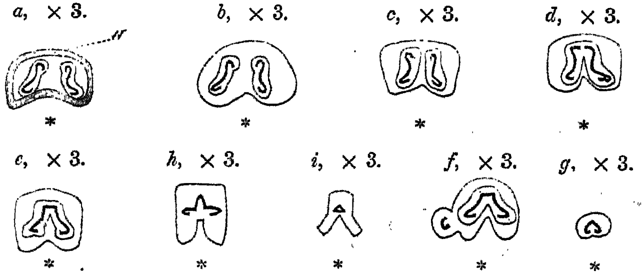
bundles in a stipes occurs, so that a section of a stipes may disclose more bundles at some part of its upper extremity than at its base, and *vice versâ.* In *Lastrea dilatata* (*Lophodium multiflorum*, Newm.) and its nearest allies, the irregularities in this respect are more pronounced than in *L. cristata* (*Loph. callipteris*).

† Throughout the figures in the present paper an asterisk indicates the axis of the stem; while the letters *x*, *y*, *z* refer to the dark sheath, to the small cells, and to the large scalariform vessels of the vascular bundles, respectively: the cortex, if given, is marked *w*.

in the interior of the stipes, though its strong cortical layer is thick and deeply coloured. The vascular bundles also differ in form very strikingly from those of allied species (excepting *N. Thelypteris*). Figs. 5 *a*, 5 *b*, and 5 *c* represent stipital sections made respectively at the junction of the stem and stipes, at midway between that point and the origin of the first pair of pinnæ, and at a short distance below the first pair. The central portion of each fasciculus has a form still more closely resembling that of the Greek Σ than does the corresponding part in *N. Thelypteris*; it is conspicuous from its whiteness, and consists mainly of large scalariform ducts. Fig. 5 *d* shows the approach of the bundles above the origin of the second pair of pinnæ, while 5 *e* shows their junction after the seventh pair. The appearance of the rachis after the twelfth pair is given in fig. 5 *h*; a leafy wing to the rachis originates after the sixteenth pair of pinnæ, and is represented in fig. 5 *i*. Figs. 5 *f* and 5 *g* illustrate the origin† and form of the vascular bundle proceeding to the eighth pinna. This partial bundle originates in precisely the same manner as the partial bundle in *Osmunda regalis* described (for the sake of elucidating this point) further on.

Fig. 5.



*Osmunda regalis.*

The disposition of the vascular tissue in the stipes of *O. regalis* is remarkably different from that of the other ferns which I have described. Dr. Ogilvie's account is accurate in the main. I will therefore here merely direct attention to a series of diagrams illustrating the structure of the stipes, &c. at different points. Fig. 6 *a* shows the stipes, of the natural size, at its insertion into the stem, and discloses on the exterior two wings of soft white cellular tissue, the cortical layer, and the interior parenchymatous tract in which the vascular bundle lies. This bundle has the form of a crescent, each end of the crescent being a volute. On the *convex* side of the crescentic fasciculus, and away from the axis of the stem, a few small dark tracts may be observed, and occasionally two or three others may be detected on those aspects of the volutes which most nearly approach. [Dr. Ogilvie finds the dark tracts on the concave aspect of the fasciculus: I have never observed this.] These dark tissues are hardly to be distinguished from true woody fibre. Figs. 6 *b*, 6 *c*, 6 *d*, 6 *e*, 6 *f*, 6 *g* are diagrams intended to trace the origin of the vascular bundle which branches off to the first pinna. Not only do the various foreign forms of this plant exhibit the same disposition of the vascular tissue in the stipes, but an identical arrangement in species of *Osmunda* generally thought to be distinct, such as *O. Claytoniana.*

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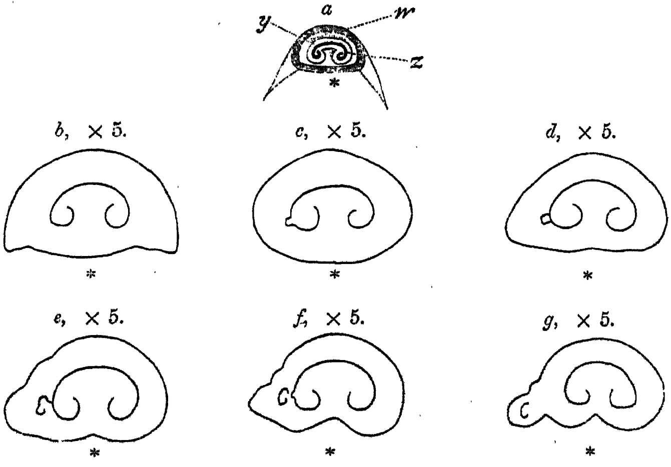
† The term 'origin' is employed in reference to the actual state of the vascular cord at different parts of the stem at the same time—to its condition in space, not to its development in time.

Fig. 6.

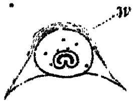


*b*, × 5. *c*, × 5. *d*, × 5.

*e*, × 5. *f*, × 5. *g*, × 5.

*Todea*, the other genus of Osmundaceæ, ought to show some analogy in the form of its vascular bundles with that of *Osmunda*. A transverse section of a young frond of *T. Africana* (fig. 7) disclosed a row of scalariform vessels arranged as a crescent, closely resembling that of *Osmunda regalis*, but simpler. As in *O. regalis*, the fascicle had no dark sheath, but a few black fusiform woody fibres interspersed sparingly in the simple parenchyma of the base of the stipes: a white, soft and

Fig. 7.

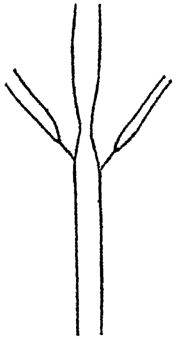


fibrous wing on either side of the base of the rachis is another point of resemblance to *Osmunda*.

*Gymnocarpium Phegopteris*, Newman.
*Polypodium Phegopteris*, Hooker, Moore.

Two vascular bundles* with dark sheaths traverse the stipes, in the foci of whose ellipse they are situate. As the first pair of pinnæ do not originate exactly opposite one another, one of the vascular bundles branches off before the other, sending off into the lowest pinna a single branch, which soon divides into two—these continuing almost to the apex of the pinna: the same phenomena are to be noted with reference to the other vascular cord, and, in both, are repeated to the apex of the frond. Just after each branching of the main cords they approach, but soon recover their relative position. (See fig. 8.)

Fig. 8.



A few words in conclusion as to the special bearings of the present inquiry. First, it may be affirmed that the disposition of the vascular tissue in all the British varieties and indistinct species of Hooker's genus *Nephrodium* is nearly alike. Secondly, that there is no marked distinction between the genus *Aspidium* (*Polystichum*, M.) and the genus *Lophodium* (*Lastrea*, M.) in this particular. (I have examined many foreign species of *Polystichum* with the same results.) Thirdly, that the genus *Lastrea* of Moore contains two British species (and many foreign ones) which possess a totally different arrangement of their vascular tissue, and that this fact, taken in connexion with the other previously recognized outward differences of these *very same* species, almost warrants their removal to another genus. And fourthly, that genera whose outward characteristics are conspicuously distinct, exhibit marked differences in the arrangement of their vascular fasciculi, while closely allied genera do not.

I will not weary the Society with further details, but beg it to accept the present communication as a small selection from those results at which several hundred observations have enabled me to arrive.

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* In *Polypodium Phegopteris* a close approach to the sigmoid figure in the vascular bundles of *L. Oreopteris* and *L. Thelypteris* is made. The same observation applies to the foreign species *P. hexagonopterum*, and, with modification, to the genus *Onoclea*. The genus *Asplenium* includes two or three apparently distinct arrangements, and demands more complete examination.

# Notes on the *Loranthaceæ*, with a Synopsis of the Genera. By DANIEL OLIVER, F.L.S., Professor of Botany, University College, London.

[Read January 15, 1863.]

I HAVE been engaged for some time upon an examination of the Loranthaceæ; and as it is my intention to continue their study chiefly with reference to certain analogies which they present with Gnetaceæ, I venture to lay before the Linnean Society some notes which I have accumulated upon the genera of the Order, which may be useful to botanists working them up in further detail. A Synopsis of the genera follows these notes.

I do not enter, at present, upon the relationship which every one acknowledges to subsist between the Loranthaceæ and Santalaceæ. My opinion strongly inclines to their union as subdivisions of one Order. Indeed M. Baillon may be right in proposing that both Olacineæ and Santalaceæ be united with Loranthaceæ*. As, however, in any arrangement based upon the Candollean sequence it would be impossible to arrange these groups consecutively—one Thalamifloral, another Calycifloral, and the third Monochlamydeous, —I fear we shall be apt to follow the more convenient course and keep them apart as hitherto. In the present notice I have omitted *Myzodendron*, which cannot be included in Loranthaceæ as distinct from Santalaceæ, any more than *Henslovia* and an Indian leafless parasite in Sir W. J. Hooker's herbarium, the name of which is uncertain. Mr. Miers's proposal to separate *Myzodendron*, with *Viscum* and some allied genera, from *Loranthus*, erecting them into a distinct Order, *Viscaceæ*†, rests, I believe, chiefly upon an incorrect view of the structure of the ovary and fruit in these plants. Since the recent researches of Hofmeister into the embryogeny of *Loranthus*, *Viscum*, and *Lepidoceras*‡, no doubt can remain that these are all characterized by a single erect ovule, often almost entirely adnate with the wall of the ovary. My own observations confirm this view. As is shown by Hofmeister, there has been much confusion of embryo-sacs with ovules by observers. The plants referred by Korthals to *Tupeia* with pendulous ovules (*vide* Mr. Miers in Lindl. Veg. Kingd. 791 *c*) are species of *Henslovia*, as stated by Blume§. Mr. Miers describes the embryo of Loranthaceæ, distinguished from Viscaceæ, as "enclosed in thin, almost pellicular albumen, filling the cell," and the fruit as "containing a subcoriaceous putamen." *Loranthus* is figured by Blume, Griffith, and others as with abundant albumen; and so I find it in the seeds of the Indian species which I have examined. In *L. europæus*, too, it is abundant. I cannot doubt, therefore, that Mr. Miers has had old or decayed fruits for examination, in which the albumen had shrivelled up from the enclosed embryo, and that the albumen has been taken for a layer of the pericarp (putamen).

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* Adansonia, ii. 380.

† Ann. Nat. Hist. ser. 2. viii. 179; and Lindley, Veg. Kingd. 791 *c*.

‡ Transl. in Ann. Sc. Nat. 4$^{e}$ sér. xii. 9.

§ Mus. Bot. i. 243.

In the notes and technical descriptions which follow, I speak of the *calyx* and *corolla* of *Loranthus*, and the *perianth* of *Viscum* and the genera allied to it. I am fully aware of the reasonable objections to this application of terms, but I apprehend they are as little likely to be misunderstood as any I could employ for the purposes of the present communication.

## LORANTHUS, *L.*

I have revised the Sections of this large genus as established by Blume, DeCandolle, and Martius, though without a result so satisfactory as I could wish. The divisions of these botanists must furnish the basis of any distribution of the species into natural groups, although the sections of Von Martius appear to have been drawn up with reference too exclusively to Brazilian forms, those of Blume to Asiatic and Archipelago species. I feel convinced that generic value cannot be attached to any of these sections; the principal structural characters upon which they rest applying chiefly to the cohesion of the petals, the number of bracts to each flower, whether one or three, and the form of inflorescence. The more important character afforded by the mode of attachment of the anther to the filament, and which, like the Atlantic, separates the species of the New from those of the Old World, though not without exceptions on both sides, does not appear of such great absolute value in itself as to serve as a mark of generic distinction. The basifixed or versatile anthers I do not find associated generally with any particular set of minor characteristics serving to endorse a generic validity. Some forms differing in this particular, are in other respects nearly the same. Neither do I believe the form of the anthers available for the grouping of species except in a subordinate way, though in two or three sections they are certainly very different from the rest. The genus, as *Loranthus*, is a good and natural one—well-defined and easily recognized; but if broken up, it will be found, as in other too familiar instances, that though many of our genera are recognizable by artificial characters, and some form natural though not always well-defined assemblages of species, yet others would be less favoured, and, without a reference to geographical distribution, not easy to limit or make out. Geographical distribution I conceive to be available only for the artificial distribution of species, &c. for convenience of reference, not for the higher purposes of study. I have endeavoured therefore to be little influenced by it; nevertheless it will be seen that, generally, the distribution of the species of each group is comparatively circumscribed.

### VISCUM, *L.*

It is interesting to note that the species having persistent perianth-lobes all belong to the aphyllous group, and, excepting perhaps one or two from the mainland of Asia, are confined to the Archipelago and islands of the Indian and Pacific Oceans.

### GINALLOA, *Korthals.*

I have not seen authentic specimens, but I have no hesitation in identifying a few leafy species from the Indian Archipelago, having the flowers in axillary or terminal articulated spikes, with this genus, which, I apprehend, must be maintained on the ground of its free anthers (*i. e.* not adnate to the perianth-lobes), not chambered as in *Viscum*, but either truly two-celled and subdidymous, or opening along the connective on the inner face of the anther. I have had but few male flowers in a state fit for examination, so that possibly further observation may lead to a modification of the generic diagnosis in order that the species which I describe under *Notothixos* may be included in this genus. The *Viscum floccosum* of Mr. Thwaites, with the habit of *Ginalloa*, has the anthers of *Notothixos.* A second Ceylon species, *V. spathulifolium*, Thw., from its very close resemblance to Malayan specimens of *Ginalloa*, I have little doubt must belong to Korthals's genus, though I have not access to staminate flowers to enable me to decide the point.

### NOTOTHIXOS, gen. nov.

*Viscum cornifolium*, Cunningham, *V.*? *subaureum*, F. Mueller, and *V. incanum*, Hook., from Eastern Australia, I propose to separate generically. They differ from *Viscum* in habit and in the anthers, which are free, more or less reniform, transversely lobed by a faint sutural line, and each lobe obscurely chambered as in some African species of *Loranthus*. This transverse chambering of the anthers is distinct in *N. cornifolius*. From their minuteness in the other species it is with difficulty discernible. In *N. floc-*

*cosus* the anthers in bud resemble those of *Viscum*; but they are free, and I doubt if the dehiscence be by pores as in that genus. The stellate pubescence of this Ceylon plant is similar to that of two of the Australian species.

### ARCEUTHOBIUM, *Bieberst.*

The bifid perianth of the ♀ flowers, which are terminal, or opposite in the axils of the sheaths, distinguishes this genus from *Phoradendron*. I cannot agree with Prof. Grisebach in referring to *Arceuthobium* the West-Indian species described in his 'Flora of the British West Indies' (p. 315). They appear to me undoubtedly aphyllous species of *Phoradendron*.

### PHORADENDRON, *Nutt.*

I have not undertaken to arrange subdivisions of this large genus; they will form an interesting study for the botanist who may have to elaborate the Loranthaceæ of the 'Flora Brasiliensis.' The leaves are wanting, or reduced to squamæ, in but few species. The anthers are described as two-celled; and so they usually are in some species, for example in *Ph. flavescens* of the United States; but in others they are certainly one-celled, probably by confluence of the pores or slits of dehiscence. Indeed, in *Ph. flavescens* I have found the anthers occasionally thus one-celled. I have therefore modified the diagnosis in this regard. The species with one-celled anthers, referred to *Arceuthobium* by Dr. Grisebach in his 'Flora of the British West Indies,' appear to me to belong properly to *Phoradendron*. His *Ph. buxifolium* (Pl. Cubenses, 220) and *Ph. serpyllifolium* (Wright, Pl. Cub. no. 1254) have certainly one-celled anthers. A few leafless or nearly leafless species much resemble *Arceuthobium* at first sight, especially those which have the floriferous internodes excessively short and only two-flowered, the flowers being almost or quite in the axils of the sheaths. The flowers are, however, more or less immersed in the rachis, and have three-lobed perianths. The *Castrea falcata* alluded to by St. Hilaire (Leçons, p. 451, and fig. 335) I presume must be a *Phoradendron*.

### ANTIDAPHNE, *Poeppig.*

To this imperfectly described genus I refer a Venezuelan plant with ♀ flowers collected by Fendler, and another (♂) by Seemann in Veraguas. I feel no doubt these belong here, having a Peruvian specimen of the original *A. viscoidea* in the Hookerian herbarium, besides Poeppig's rather imperfect figure of it, to guide me. The northern plants are probably distinct species, judging from the venation of the leaves. I am enabled by their aid to correct some inaccuracies in the generic description, which have been adopted by Endlicher, who, after Poeppig, describes the ♂ flower as "tubo filiformi," and with stamina "limbi laciniis alterna." The "tubus" is the pedicel; the "laciniæ," the lobes of a thickened disk. In Seemann's ♂ plant I observe a pair of setiform bract-like processes, which I was in doubt whether to regard as lateral bracteolæ or reduced perianth-segments. As they appear to be opposite to stamens, I conclude they are the latter. The Peruvian plant appears destitute of them. In this genus, as also in *Lepidoceras*, I have noted interesting relations to subsist between the *Nieder-*, *Laub-*, and *Hoch-blätter* of Braun. In describing these, I shall employ the terms used by Mr. Henfrey, derived from Greek roots, viz. *cata-*, *eu-*, and *hypso-phyllary* (scale, foliage-leaf, and bract) leaf-formations. The spikes of both ♂ and ♀ flowers found in the axils of the leaves or clustered about the apices of the branches are at first strobilus-like, covered with numerous dry imbricating scales, the lowermost of which are empty and truly cataphyllary. These pass into others quite similar in structure, though larger, subtending the flowers. After these and continuous with them, though with rather abrupt transition in respect to texture and duration (for the dry scales are caducous), come the young euphyllary leaves, which unfold themselves as the spike elongates. We thus always find the young fruits scattered along the lower, bare portion of the shoots, the bracts having long since fallen away. The upper portion bears the leaves, in the axils of which these formations are repeated. I must refer to *Lepidoceras* for a case somewhat similar, though in some respects more remarkable. Compare also the account of the ramification, &c. of *Myzodendron*, by Dr. Hooker (Flora Antarctica, ii. 290).

### EUBRACHION, *Hook. fil.*

It is unfortunate that I am unable to add more to our knowledge of this rare and curious plant. It will be seen in the appended Synopsis that we do not possess technical characters of importance to distinguish it. In habit the plant looks very different from any of its allies. Anyone visiting Uruguay will do well to have an eye to it.

### LEPIDOCERAS, *Hook. fil.*

The two species originally described briefly by Dr. Hooker in the 'Flora Antarctica' are the only ones known to me, the

*L. punctulatum* of Clos in Gay's 'Fl. Chilena' (iii. 163) having been separated by Prof. Grisebach. Clos ought not to have united the two species of Dr. Hooker; they look distinct, and are so held by Grisebach (Pfl. Phil. und Lechl. 23). The proportionally large embryo and reduced albumen in this genus, pointed out by Grisebach and Hofmeister, offer a remarkable feature in the Order. I have seen nothing like it in allied, or indeed any Loranthaceæ. If I understand Hofmeister's figure rightly (Ann. Sc. Nat. 4e sér. xii. t. 3. fig. 32), the membrane of the conical body *g* answers to the 'endocarp' in *Viscum* of Decaisne, which he describes "sous la forme d'une pellicule verdâtre . . . . . parcourue par un réseau vasculaire," and is no part, I think, of the ovule proper, as Hofmeister regards it, although enclosing and (as in *Viscum* at first) entirely adnate with it*.

I have alluded to the relations of the bud-scales, leaves, and bracts in *Lepidoceras* while speaking of *Antidaphne*. My attention was directed to them by the explanation which I stumbled upon of the remarkable scaly tips of the leaves from which the genus derives its appellation. The young ♀ flowers are found in small axillary strobili formed of numerous dry imbricating scales. The outermost and lowest of these scales, as in *Antidaphne*, are empty and truly cataphyllary; the succeeding (hypsophyllary) scales subtend the flowers. These, however, are not caducous, as in that genus, but persistent. As the axis of the cone grows out, the hypsophyllary scales (bracts) become borne up on the apices of the euphyllary or ordinary leaves of the plant by the development of a true lamina continuously with the base of each. The scaly bracts persist, crowning the extremity of the leaves, sometimes separated from them by a constriction, which answers to the narrowed base or petiolar portion of the scale while doing duty as a bract. The scales subtending the ♂ flowers are early deciduous, though, as the leaf-buds are scaly, we find the developed leaves, as in the ♀ plant, terminated with dry scales.

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* With regard to this so-called 'endocarp,' which in most species of *Viscum* and *Phoradendron* is readily separated from the rest of the ripe pericarp by simply squeezing the latter when separated from its peduncle, I feel inclined to believe that it has much in common with a corresponding layer, not however thus easily separable, in *Gnetum*, *Welwitschia*, *Ephedra*, and perhaps other Gymnosperms. In *Viscum* and *Phoradendron* (which appear to have the nucleus always more or less adnate to the wall of the ovary) we find this membrane separating the seed from the viscine cells of the pericarp, with which its outer surface is organically continuous. It is usually (?) traversed vertically by two principal conspicuous bundles of vessels, which often branch a little above. In many cases, however, more than two bundles traverse it: sometimes they are numerous and anastomose, as in *V. album*. When several are present, they may, sometimes at least, be found to converge at the base towards two opposite points. I hope to return to the consideration of this layer at a future time.

### EREMOLEPIS, *Grisebach.*

The appended Synopsis shows that I have had imperfect material for the study of this genus, having access only to ♂ flowers of *E. verrucosa* and ♀ of *E. punctulata.* The former are in small axillary strobili, each flower in the axil of a scale-like deciduous bract, and enclosed by two lateral bracteoles (absent in *Lepidoceras*). The perianth I always find 5-partite. As Grisebach describes *Eremolepis* (♂) with '*calyx tripartitus*,' he may have borrowed this character from the figure in the Atlas to 'Fl. Chilena.'

The bark of *E. verrucosa* is studded all over with minute papillæ, which, when traced up the petioles and to the lamina of the leaves, appear to be due to an altered condition of the stomata. This recalls the parallel case of *Myzodendron,* in which genus, as in *Eremolepis,* we have a single species differing from its congeners in the presence of these remarkably hypertrophied organs. *M. punctulatum,* however, being aphyllous, does not so readily permit the observation of a graduated series between the normal and tubercular stomata. The leaves, as observed by Grisebach, are destitute of apical squamæ. I doubt if the Cuban plant of Wright be correctly referred here by Prof. Grisebach in his 'Plantæ Wrightianæ,' 192. The plant is monœcious, though not so described. The perianth-lobes of the ♀ flower are persistent; and there are some other points of difference. I do not venture to separate it under a new name. We must await further discoveries before finally settling what to do with it.

## GENERA OF LORANTHACEÆ.

### 1. NUYTSIA, *R. Br.*

Fructus monospermus, siccus, trialatus. Embryo cotyledonibus 3–4 inæqualibus.

*N. floribunda,* R. Br., we have from Murchison River, Swan River, and King George's Sound. Of the *N. ligustrina,* A. C., of Mueller's 'Fragmenta,' ii. 130, from New South Wales, no fruit has been seen that I am aware of. It remains therefore a doubtful congener.

### 2. Loranthus, *L.*

A. Antheræ dorso affixæ (in speciebus plurimis sectionis *Struthanthi* parvæ, prope basin affixæ).—*Notanthera*, A. P. De-Candolle, Mém. Loranth. 17.

I. Flores parvi, sessiles, singuli in fovea rhacheos inserti, vel in axillis foliorum dense congesti, bractea bracteolisque minutis abortivisve.

*a.* Inflorescentia spicata.

§ 1. *Oryctanthus*, Griseb. Fl. Brit. W. Ind. 313.

Bracts at first imbricating, at length obsolete or, with the bracteoles, as minute scales in the depressions. Anthers usually alternately shorter, and, especially the shorter ones, minutely apiculate. The connective is sometimes dilated in front, sometimes narrow. The petals are free. The spikes in some species much abbreviated. —(*Euloranthus* § *Stachyanthi*, DC., in part*.)

*Hab.* Mexico, Panama, W. Indies, Columbia and New Granada, N. Brazil.

*b.* Flores dense glomerati v. fasciculati, axillares.

§ 2. *Phthirusa*, Mart. Regensb. Flora, 1830, 110.

The flowers I find 4–6-merous, and the connective, at least in some species, apparently adnate to the petals.

*Hab.* Brazil.

II. Flores pedicellati v. sessiles, singuli bractea bracteolisque tribus sejunctis vel connatis vel bractea cupuliformi fulti.

*a.* Flores parvi, 6–5-meri, in racemis axillaribus. Stamina filamentis brevibus subnullisve.

§ 3. *Dendropemon* et *Lipotactes*, Blume, Fl. Jav. Loranth. 13.

The flowers are sometimes nearly sessile and spicate. Bract and bracteoles confluent, forming small 3-lobate or entire cupules. Petals usually 6, at length free. Stamens alternately longer. Anthers often reniform and apiculate. *L. pauciflorus*, Sw., the only species of Blume's Section *Lipotactes*, does not differ materially from the rest. The anthers are not quite sessile.

*Hab.* W. Indies.

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* I refer here also *Spirostylis*, Presl (Schultes, Syst. Veg. vii. 163). Mr. Bentham's *Loranthus Grahami* (Pl. Hartwegianæ, 62) is the only species I have seen; and I think it probably the same as Schultes described.

The flowers seem 1-sexual by abortion; the anthers being imperfect in the ♀, and the style straight and reduced in the ♂. I scarcely think the twisting of the style is of sectional importance. The flowers are rather larger than in § *Oryctanthus* generally, being near ¼ in. in length.

The *L. diversifolius*, Benth. Pl. Hartweg. 63, I am at a loss to know what to do with, unless I leave it here for the present. Each flower has a small subcupulate bract, which is sometimes reduced to a mere ring.

*b.* Flores in corymbos v. paniculas cymosas vel racemos compositos terminales v. axillares, raro in racemos simplices v. spicas dispositi, in speciebus paucis solitarii v. geminati axillares, sæpius 1–3 unc. longi.

§ 4. *Psittacanthus*, Mart., et *Tristeryx*, Mart. Reg. Flora, 1830, 15. 17.

The Eastern species with basifixed anthers included in *Tristeryx* and *Psittacanthus* by Martius are, of course, excluded. As the cupule supporting the flower in *Psittacanthus*, Mart., in many, if not in all, cases appears to result from the coalescence of three organs, viz. the bract and two bracteoles, I am not able to make a separate section of his *Tristeryx*, in which the bracts are free or only partially connate. *Loranthus aphyllus* of Mr. Miers is very near to *L. tetrandrus*, R. & P., the only species retained in *Tristeryx* by Blume. The petals are at length usually free.

*Hab.* Mexico, Central America, West Indies, Brazil, Uruguay, and Western S. America to Chili.

III. Flores "subternatim dispositi totidemque bracteis suffulti."

*a.* Flores sessiles aut raro subsessiles, sæpius parvi.

§ 5. *Struthanthus*, Mart. Reg. Flora, 1830, 102.

Flowers in terminal or axillary racemes or racemose panicles, seldom over $\frac{1}{3}$, rarely $\frac{1}{2}$ in. long. (*Euloranthus* § *Protostelides*, DC. *Passowia*, Karst. in Bot. Zeit. 1852, 305.)

*Hab.* W. Indies, Panama, Mexico, Guiana, Venezuela, Brazil, Uruguay, and Western S. America to Chili.

*b.* Flores subternatim dispositi, pedicellati vel centrali sessili, singuli 1-bracteati, bractea calycem frequenter superante plus minus foliacea raro 0. (Flores in speciebus paucis in racemis terminalibus subterni v. alterni bractea cucullari calycem sæpe superante.)

§ 6. *Taguana*.

Including the '*Oscillantheræ Taguanæ*' of M. DeCandolle, referred to *Struthanthus* by Blume, and *Gaiadendron* of Don, Gen. Syst. iii. 431. They seem to form a distinct natural group with terminal inflorescence and rather large flowers.

*Hab.* S. America: New Granada, Columbia, Peru, Chili, and S. Brazil.

A few E. or S.E. Australian and Polynesian species I refer here for the present, including *L. eucalyptoides* and *L. celastroides*. These do not consort well with the American species.

IV. Antheræ dorsofixæ, immobiles.

§ 7. *Loxanthera*, Blume, Fl. Jav. 15.

This curious mode of attachment of the anther appears confined to one or two species of the Indian Archipelago and Malacca. It is well figured by Blume, *op. cit.* t. 23. *c.* Of the Malacca plant I have seen flowers only.

B. Antheræ basifixæ v. adnatæ.

I. Flores singuli tribracteati (bractea 1, bracteolis 2).

*a.* Flores singuli in foveam rhacheos leviter inserti, in spicis axillaribus paucifloris decussatim oppositi, bracteis primum tecti.

§ 8. *Elytranthe*, Blume, Fl. Jav. Loranth. 16.

Petals 5–6, connate below.

*Hab.* India.

*b.* Flores pedicellati v. sessiles, sæpius racemosi aut cymosi, axillares, interdum in nodis subsessilibus.

§ 9. *Macrosolen*, Blume, Fl. Jav. Loranth. 16.

Petals 5–6, united below, or sometimes free. (*Symphyanthus* § *Anguliflori*, DC.)

*Hab.* India.

II. Flores capitulatim congesti, bracteis numerosis imbricatis involucrati. Petala 6 coalita.

§ 10. *Lepeostegeres*, Blume, Fl. Jav. Loranth. 18.

A very remarkable and distinct section, so far as inflorescence is concerned. In a plant from the Philippines the bracts seem considerably fewer than in the other species.

*Hab.* Borneo, Java, Philippines.

III. Flores 4–6, congesti, bracteis totidem distinctis v. involucro 1-phyllo coalitis cincti.

§ 11. *Tolypanthus*, Blume, Fl. Jav. Loranth. 18.

*L. lageniferus*, figured by Wight (Ic. 306), is the only species I know in which the bracts form a monophyllous involucre.

*Hab.* India.

IV. Flores sæpius pedicellati, singulatim 1-bracteolati. Petala coalita. (*Dendrophthoë*, Mart. Reg. Flora, 1830, 109.)

*a.* Flores sæpius 4-meri. Ovarium demum obconicum v. clavatum.

§ 12. *Cichlanthus*, Endl. Gen. Pl. 802.

*Hab.* India and the Archipelago.

*b.* Flores sæpius 5–6-meri, corolla subinde lateraliter fissa. Ovarium basi rotundatum.

§ 13. Subsect. i.

*Eudendrophthoë*, Endl. *l. c.*—Flores sæpius racemosi vel racemis reductis abbreviatisve geminati v. fasciculati, raro solitarii aut in speciebus perpaucis (*L. sclerophyllus*, Thw. &c.) umbellati, corolla basi nunquam inflata.

*Hab.* India and the Archipelago. Australia.

*c.* Flores 5 (rarius 4) -meri, axillares, geminatim ternatimve fasciculati, interdum solitarii aut umbellati, raro racemosi, pedicellati v. sessiles, singuli unibracteati.

§ 13. Subsect. ii.

(*Tapinanthus*, Blume, Fl. Jav. Loranth. 15, in part ?)

The corolla is frequently much dilated at the base, the cells of the anthers in some species multilocellate, and the filament often more or less produced at the base of the anther. I do not find that these afford sectional characters.

*Hab.* Africa: Abyssinia, West Tropical Africa, Cape, Natal, &c.

*d.* Flores 4-meri, racemosi, bracteis minutis obsoletisve.

§ 14.

*L. flavidus*, Hk. f., of New Zealand.

V. Flores 5-meri, geminatim v. umbellatim dispositi, singuli 1-bracteati. Petala libera v. basi æqualiter coalita.

§ 15.

*Hab.* A very few species of Abyssinia and the Cape (*L. undulatus*, E. M., and *L. Acacieæ*, Zucc.).

VI. Flores sæpius subternatim cymosi v. umbellatim v. cymosim paniculati, axillares, raro solitarii v. geminati, pedicellati v. sessiles, singuli 1-bracteati. Petala discreta 5, 6, 4.

§ 16. (*Euloranthus* § *Stylosi*, DC.)

The flowers are usually 5-merous; in the New Zealand species

4-merous. In one species, *L. bracteatus*, F. M., the flowers are enclosed in a pair of opposite foliaceous bracts.

*Hab.* Australia, New Zealand, Polynesia.

VII. Flores racemosi v. spicati, raro in nodos fasciculati, 1-bracteolati vel in foveam rhacheos leviter inserti, bractea plus minus obsoleta. Petala liberà. (*Loranthus*, Mart. Reg. Flora, 1830, 102; Blume, Fl. Jav. Loranth. 12, in part. *Euloranthus*, Endl. Gen. Pl. 801, in part. *Phœnicanthemum*, Blume, *op. cit.* 13. *Lanthorus* ?, Presl, Epim. Bot. 256.)

*a.* Flores dioici, spicati.

§ 17.

*Loranthus europæus* is the only species which I can refer here.

*b.* Flores hermaphroditi. (*Euloranthus* § *Breviflori*, DC.)

§ 18.

This group may be artificially divided either by the symmetry of the flowers, or the inflorescence, whether racemose or spicate. In *L. odoratus*, Wall., very near *L. europæus*, they are partially immersed in the rachis. The petals are often dilated at the base (*Euloranthus* § *Unguiculati*, DC.), but I am not able to base a section upon this character.

*Hab.* India and the Archipelago; and two new African species (tetramerous) from the Island of St. Thomas and E. Tropical Africa, which I describe.

**Loranthus Mannii**, sp. nov. Cortice glabro punctato, foliis oppositis suboppositisve lanceolatis vix acuminatis apicè obtusiusculis eveniis glabris petiolatis, floribus tetrameris racemosis, pedicellis calycem æquantibus, bracteis minutis, racemis axillaribus.

*Hab.* St. Thomas, alt. 5000 feet. Coll. G. Mann.

The linear anthers are adnate, two-celled, and each cell multilocellate, as in several other African species.

Leaves 2–3 in. × $\frac{6}{10}$–1 in., petiole $\frac{2}{10}$–$\frac{4}{10}$ in. Flowers $\frac{5}{10}$–$\frac{6}{10}$ in., usually curved to one side before expansion.

**L. Kirkii**, sp. nov. Cortice glabro plus minus striato, foliis oppositis alternisve ovatis v. ellipticis aut obovato-ellipticis obtusis glabris petiolatis, floribus in racemis terminalibus elongatis ∞-floris, pedicellis patentibus, bractea parva laterali, petalis 4.

*Hab.* Rovuma Bay, W. Africa, lat. 10° S. Coll. Dr. Kirk.

Branches slightly verrucose below. The racemes always terminal. Leaves ¾–2 in. × ¾–1½ in. Racemes 4–6 in. Flowers $\frac{3}{10}$–$\frac{4}{10}$ in.

VIII. Flores 4-meri petalis discretis. Stylus contortus. Bacca viscida.

§ 19.

Another solitary New Zealand species, *L. micranthus*, Hk. f.

IX.? Folia verticillata v. alterna. Flores umbellati singulatim 1-bracteati sæpius subternatim dispositi, vel racemosi ternatim sessiles, bracteis totidem fulti.

§ 20. (Umbellatæ.)

*Hab.* Philippines and Malayan Archipelago. In one species the flowers are subsessile from the nodes. (Includes Cuming's Nos. 1947, 1952, 1956, 1957, 1958, 1964.)

§ 21. (Racemosæ.)

*Hab.* Philippines. (Cuming's Nos. 1945, 1976, &c.)

X.? Flores di-trichotome cymosi, singuli bracteati, bractea cupulata obliqua v. lobata, 2½–9 unc. longi. Petala inferne coalita.

§ 22.

A few South American species included in *Psittacanthus* by Martius and Blume. I have separated them because of their adnate anthers, limiting *Psittacanthus* to species in which they are versatile.

*Hab.* Ecuador, Columbia, and the Amazon Valley. (Includes *L. macranthus*, Hook. Icones Pl. 743–4.)

*Lichtensteinia*, Wendl. (Sect. 6 of Blume, Flor. Jav. Loranth. 14), I omit, having been founded upon an error.

### 3. VISCUM, *L.*

Flores dioici v. monoici. *Fl. masc.* Perianthium 4–3-fidum; antheræ cum lobis perianthii adnatæ poris plurimis dehiscentes. *Fl. fœm.* Perianthium 4–3-lobatum. Stylus 0 vel brevis stigmate obtuso.

A. *Aphylla.*

1. *Perianthii lobis persistentibus.* (Flores ♀ in glomerulis oppositis v. interdum verticillati.) Includes species of India, Indian Archipelago, Mauritius and Bourbon, Australia, Polynesia, New Zealand. (*V. moniliforme*, *V. phyllanthus*, Cunn., *V. distichum*, &c.)

2. *Perianthii lobis caducis.* (Flores ♀ singulatim ternatimve bibracteolati, bracteolis sæpe connatis basin fructus cingen-

tibus.) Includes Indian, South African, Mauritian, and a few Australian species.

B. *Foliosa.*

1. *Perianthii lobis caducis.* (Flores singulatim v. 2-, 3-, 4-, 5-natim bibracteolati, vel flore terminali bibracteolato lateralibus 1-bracteolatis, vel bracteolis obsoletis.) Species of Europe, S. Asia, Central and S. Africa, &c. No Australian species. Includes *V. orientale*, *V. album*, &c.

### 4. GINALLOA, *Korthals, Verh. Bat. Genootschap.* xvii.

Flores monoici. *Fl. masc.* Perianthium 3 (4)-fidum; antheræ subsessiles, liberæ, biloculares. *Fl. fœm.* Perianthium 3 (4)-lobatum lobis persistentibus.—Folia opposita, sæpius 3-nervia; flores spicati, spicis articulatis, in articulis fasciculati v. solitarii oppositi, bracteis coalitis cincti.

A few species from the Malay and Indian Archipelago and Ceylon?, including *G. Arnottiana*, Korth., and *Viscum spathulifolium* (?) of Mr. Thwaites.

### 5. NOTOTHIXOS, gen. nov.

Flores monoici. *Fl. masc.* Perianthium 4 (raro 5)-fidum; antheræ sessiles, liberæ, sutura transverse lobatæ, lobis parallelis obscure ∞-locellatis. *Fl. fœm.* Perianthium 4 (3)-lobatum, lobis persistentibus.—Folia opposita, 3–5-nervia; flores capitellati, terminales, capitulis 3–9-floris pedunculatis v. subsessilibus solitariis v. geminatim v. ternatim v. paniculatim dispositis; in spec. Zeylanica flores spicati sunt.

1. N. CORNIFOLIUS. Paniculis terminalibus, floribus in capitulis 5–9-floris patentim pedunculatis bibracteolatis digitatim dispositis, foliis obovato-lanceolatis v. obovatis v. lanceolatis obtusis deinde emarginatis retusisve glabris glabrescentibusve.

*Viscum cornifolium* et *V. xanthophyllum*, Cunn. MS.

*Hab.* Hunter River and Liverpool Plains, N.S.W., Sydney, *Dr. Hooker.* —β. *angustifolia.* Brisbane River, *Cunningham, Fraser.* Moreton Bay, Queensland, *Cunningham.*

2. N. SUBAUREUS. Floribus in capitulis terminalibus 5–9-floris pedunculatis bibracteolatis radiatim dispositis, pedunculis simplicibus geminatisve aut ternatim ramosis, foliis ellipticis ovalibus vel ovato-lanceolatis obtusis v. subacutis subtus pilis aureis stellatis pubescentibus.

*Viscum subaureum*, F. Mueller.

*Hab.* Moreton Bay and Brisbane River, *Mueller.* Lake Macquarie, *Backhouse.*

Whole plant, especially the young parts, more or less clothed with golden-

stellate pubescence, the upper side of the leaves at length glabrescent. Leaves shortly petiolate. Peduncles shorter than the branches from the fork of which they spring.

3. N. INCANUS.—*Viscum incanum*, Hook. Ic. Plant. i. t. 73.
*Hab.* Brisbane River, Queensland, *Fraser*.

4. ? N. FLOCCOSUS.—*Viscum floccosum*, Thwaites, MS.

### 6. TUPEIA, *Ch. et Schlecht. Linnæa*, iii. 203.

Flores dioici. *Fl. masc.* Perianthium 4-partitum; stamina libera, filamentis elongatis, antheris ellipticis bilocularibus longitudinaliter dehiscentibus. *Fl. fœm.* Perianthium 4-lobatum, lobis caducis; stylus validus, sejungens stigmate capitato. Semen albumine copioso.

One New Zealand species (*T. antarctica*). Dr. Lauder Lindsay sends a narrow-leaved form from Otago.

### 7. ARCEUTHOBIUM, *Bieb. Fl. Taur. Cauc. Suppl.* 629.

Flores dioici. *Fl. masc.* Perianthium 3-, 4- v. 5-partitum; antheræ sessiles, uniloculares, rimula transversa dehiscentes. *Fl. fœm.* Perianthium bidentatum; stigma sessile.—Species aphyllæ.

Includes *A. oxycedri* from Southern Europe, Western Asia, California, the Rocky Mountains, and Mexico. A plant of Seemann's from N.W. Mexico (2138) seems to be the ♂ of a distinct species. Fendler, New Mexico, 283, may be another species; but more material is needed for the determination of these.

### 8. PHORADENDRON, *Nuttall, Journ. Ac. Phil.* i. 185.

Flores dioici vel monoici. *Fl. masc.* Perianthium 3-fidum; antheræ lobis imis adnatæ, transverse biloculares, poris s. rimulis verticalibus duabus dehiscentes, v. interdum rimulis confluentibus uniloculares. *Fl. fœm.* Perianthium 3-lobum (rarius 2–4-lobum), lobis persistentibus; stigma sessile, obtusum.—Frutices sæpius foliosi, paucis aphyllis. Flores sessiles, spicati, rhachi plus minus immersi, spicis interdum abbreviatis.—*Spiciviscum*, Engel. Pl. Fendl. 58, et Karst., "nec Engelm." Fl. Columb. 73, t. 36; *Allobium*, Miers, A. N. H. ser. 2. viii. 178.

All American, so far as I have had opportunity of ascertaining, extending from the United States (*Ph. flavescens*) and California, through Texas, Mexico, West Indies, to Peru and Brazil. Engel-mann (Gray, Pl. Fendlerianæ, p. 58 in note) describes the perianth, both ♂ and ♀, as rarely 2- or 4-lobate. So does Dr. Gray (Bot. Northern States, ed. 2. 382). I have seen it so sometimes in *Ph. flavescens*; but in the other species which I have examined I have found only a 3-lobate perianth.

9. ANTIDAPHNE, *Poeppig, Nov. Gen.* ii. 70, t. 199.

(CHAR. EMEND.) Flores monoici v. dioici. *Fl. masc.* Perianthium 0 aut subnullum in segmenta setiformia reductum; stamina 3 v. 4, filamentis distinctis, antheris ovatis v. oblongis bilocularibus longitudinaliter dehiscentibus. *Fl. fœm.* Perianthium sæpius 3-lobatum, segmentis remotiusculis parvis, vel (fide Poepp.) margine undulato; ovarium limbo paullo longius; stylus brevissimus, stigmate capitato.—Folia alterna, 3-∞-nervia, crassiuscula, integra. Flores ♂ strobiliformiter spicati, singulatim v. 2–3-natim bracteati, bracteis squamiformibus caducis sessilibus v. basi angustatis. Stamina sæpe inæqualia; discus crassus, lobatus. Flores ♀ sessiles, sæpius ternatim bracteati, bracteis caducis.

Of the Peruvian species I have seen only a rather imperfect specimen, collected at Casapi by Matthews; but I have no hesitation in identifying the Venezuelan plant No. 1125 of Fendler, and Seemann's No. 1619 from Veraguas, with Poeppig's genus. They are probably distinct species, but we have only male or female flowers from either locality.

10. EUBRACHION, *Hook. fil. Fl. Antarct.* ii. 291 *adnot.*

Flores monoici, in spicis androgynis brevibus lateralibus. *Fl. masc.* Perianthium 3-partitum; stamina filamentis brevissimis, antheris bilocularibus didymis longitudinaliter dehiscentibus. *Fl. fœm.* Perianthium 3-lobum; stylus brevissimus, stigmate obtuso.

Flowers, both ♂ and ♀, sessile in the axil of small, rotundate, much-thickened scales. The specimens which I have seen are so imperfect, that it is not easy to construct a more contrasting diagnosis.. But one species is known—*E. Arnottii* (*Viscum ambiguum*, Hook. et Arn. Bot. Misc. iii. 356), collected by Tweedie in Uruguay.

11. LEPIDOCERAS, *Hook. fil. Fl. Antarct.* ii. 293 *adnot.*

Flores dioici. *Fl. masc.* Perianthium 4-partitum; antheræ biloculares, longitudinaliter dehiscentes. *Fl. fœm.* Perianthium

4-lobum, lobis caducis; stylus brevis, stigmate obtuso. Semen albumine parco v. subnullo.—Folia squamula sicca apicali instructa. Flores ♂ racemosi, pedicellati, bracteis squamæformibus caducis: ♀ primum in spicis strobiliformibus sessiles, deinde (fructu) solitarii in axillis foliorum.

The only species known to me are, as above explained, *L. Kingii* and *L. Dombeyi*, Hk. f., from Peru, Chili, and the island of Chiloe.

### 12. EREMOLEPIS, *Griseb. Pfl. Phil. und Lechl.* 36.

Flores dioici (fide Grisebach, *l. c.*). *Fl. masc.* (in *E. punctulata*): Perianthium 5-partitum; stamina filamentis brevissimis, antheris bilocularibus longitudinaliter dehiscentibus. *Fl. fœm.* (in *E. verrucosa*): Perianthium 3-lobatum, lobis caducis; stylus brevissimus, stigmate obtuso. Semen embryone cylindrico, albumine copioso.—Folia alterna, squamulis apicalibus destituta. Flores ♂ sessiles, bracteati, in bracteolis 2 lateralibus alabastri inclusi. Perianthium lobis crassiusculis apice mucrone parvo inflecto instructis. Pistillum rudimentarium, minute 3-fidum. Flores ♀ in spicis paucifloris brevissimis quasi glomerulati, sessiles, bracteis parvis caducis.

*E. verrucosa* and *E. punctulata* are the only species known to me, unless Grisebach be right in referring to this genus the following (*vide supra*, p. 96).

### 13. Genus novum? (*Eremolepis Wrightii*, Griseb. Pl. Wright. 192.)

Flores monoici. *Fl. masc.* Perianthium 4-partitum; stamina filamentis brevissimis, antheris bilocularibus oblique lateraliter dehiscentibus. *Fl. fœm.* Perianthium 3–4-lobum, lobis persistentibus. Albumen copiosum.—Folia alterna. Flores in spicis brevissimis paucifloris axillaribus, bracteati, bracteis parvis triangularibus.

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## On the Spicula contained in the Wood of the *Welwitschia*, and the Crystals pertaining to them. By Colonel PHILIP YORKE, F.R.S. In a letter to Dr. J. D. HOOKER, F.R.S., &c.

[Read February 5, 1863.]

Febr. 4, 1863.

DEAR DOCTOR HOOKER,—I send you a note of my observations on the spicula contained in the wood of the Welwitschia, and the crystals pertaining to them.

I found, as I believe you had already, that when the spicula were immersed in dilute hydrochloric acid, even though they remained in the liquid several hours, there was no action on the crystals.

Also that when the spicula were placed in a platinum spoon with hydrofluoric acid and heated, and when the same was done with a solution of caustic soda, there was no apparent action on the crystals.

On the other hand, when the spicula were boiled in nitric acid, the crystals disappeared.

I then found that when a few spicula were carefully burned by heating them on platinum foil over a small spirit-flame, a white ash remained of the form of the spicula; and when this ash, moistened with water, was examined by the microscope, it was found to be made up of a congeries of the crystals unaltered in form, and acting on polarized light.

When a drop of dilute hydrochloric acid was added, the crystals disappeared, and, I thought, with effervescence. I then made the following experiment.

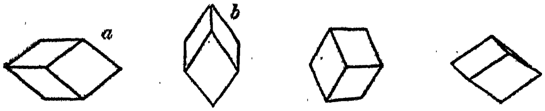
A quantity of the spicula was collected which weighed 0·105 gr.; this was carefully burned as before; the ash weighed 0·010 gr., or just 10 per cent.: water added to the ash, the liquid slightly restored the blue of reddened litmus; a drop of hydrochloric acid added, the ash dissolved with brisk effervescence; and when this, neutralized by ammonia, was tested by oxalate of ammonia, a considerable precipitate formed.

The supernatant liquid was removed, and tested by phosphate of soda; but a very minute, if any, precipitate was thus formed.

This experiment shows that the substance examined is essentially carbonate of lime, possibly with a little carbonate of magnesia.

The form of the crystals also supports this view, though their minuteness renders the examination difficult. By far the greater number of the crystals presented a rhombic outline, the largest measuring in their longer diagonal $\frac{1}{2000}$th of an inch. I obtained

*Sketches of the crystals.*



some approximation to the measure of the angles by means of a doubly refracting prism fitting on to the eye-piece of the microscope; the mean of several measures gave 106° nearly as the value of the obtuse angle (that of calc-spar being 105° 5′). With regard to the prismatic-looking crystals occasionally seen, I found several which, examined by favourable light, presented the figure *a, b.*

This form of rhomboid resembles that which was called by Haüy the "inverse," a peculiarity of which is, that its plane angles measure the same as the dihedral angles of the primary rhomboid.

The crystals of the so-called crystallized sandstone of Fontainebleau (which are carbonate of lime containing sand) are instances of this form.

As it appears from what I have stated that these crystals consist of carbonate of lime, the question remains, What is it that protects them from the action of acids?

I have made some attempts, but very imperfect, to throw some light on this question.

I found that alcohol and ether, even when heated, had not the power of removing the protecting substance.

But I found that if, after digesting with ether, the spicula were boiled in solution of caustic soda and subsequently immersed in dilute hydrochloric acid, the crystals disappeared, and their places were occupied by amorphous patches.

There is one objection that may perhaps be taken to the view I have adopted as to the nature of the crystals, which I may as well notice. It may be thought that in the plant the lime was united to some organic acid, say the oxalic. But I think it will be admitted that, putting aside the agreement in form with carbonate of lime, the fact of the crystals being unaltered in form by burning, and retaining the power of acting on polarized light, is fatal to such an hypothesis.

I remain,
Dear Doctor Hooker,
Very truly yours,
PH. YORKE.

*Joseph D. Hooker, Esq., M.D., &c. &c.*

# On some new Species of *Amomum* from West Africa. By Professor OLIVER, F.L.S., and DANIEL HANBURY, Esq., F.L.S.

[Read April 16, 1863.]

WE have in preparation a monograph of the West African species of *Amomum*; but as there are yet some points to be cleared up, requiring further communication with residents at Sierra Leone and the ports of Liberia and of the Gulf of Guinea, we shall not be in a position to complete it during the present session of the Linnean Society. It appears, however, to be desirable that brief diagnoses of the new species should at once be laid before the Society, and we have accordingly prepared the following.

Specimens of all the plants described have been received, both in the dried state and preserved in fluid, accompanied in most cases by coloured sketches, from Mr. Gustav Mann, the able and persevering botanical collector to the Royal Gardens, Kew. In the Museum and Herbarium of this establishment the authentic specimens are deposited.

## AMOMUM, *L.*

* *Scapi uniflori. Semina ellipsoidea, nitida.*

1. A. ARUNDINACEUM, sp. nov. Foliis lineari-lanceolatis, glabris, subsessilibus, scapis gracilibus 2–3 unc. longis, bracteis brevissime apiculatis, labello erecto rotundato-obovato, fructu late ovoideo nudo vel subnudo.

*Hab.* Corisco Bay, 1862, *G. Mann.*

** *Flores 2–10 congesti, in scapis simplicibus aut disticha ramosis.*

*a.* Labellum erectum, amplum, roseum v. purpureum. Folia glabra.

† *Scapi 1–2-pedalis, disticha ramosi.*

2. A. GIGANTEUM, sp. nov. Foliis amplis, elongatis, lanceolato-oblongis oblanceolatisve petiolatis, scapi ramulis sæpius bifloris, antheræ crista lobo centrali producto quadrato-oblongo bifido v. subintegro, fructu ovali-lanceolato, seminibus ellipsoideis nitidis.

*Hab.* Gaboon River, 1861, *G. Mann.*

†† *Scapi simplices, aut breves basi ramosi.*

3. A. SCEPTRUM, sp. nov. Foliis auguste oblongo-lanceolatis, petiolatis, ligula scariosa, scapis simplicibus apice clavato-turgidis circa 10-floris, bracteis superioribus dorso apicula tis, tempore florifero transverse plicatis, fructu ovoideo-compresso v. subtrigono glabro, pericarpio crasso, seminibus angulatis.

*Hab.* Gaboon River, 1861, *G. Mann.* 1084

4. A. MANNII, sp. nov. Foliis oblanceolatis ellipticisve abrupte acuminatis, petiolatis, scapis 2–3 unc., 3–2-floris, bracteis brevissime apiculatis v. muticis, labello late obovato-rotundato.
*Hab.* Corisco Bay, 1862, *G. Mann.*

*b.* Labellum erectum, amplum, roseum v. purpureum. Foliis subtus minute pubescentia v. margine breviter pilosa. Staminodia libera.

5. A. SUBSERICEUM, sp. nov. Foliis lanceolatis acuminatis, brevi-petiolatis, subtus pubescentia venulis transverse intertexta subsericeis, scapis brevibus sæpius bifloris, fructu ovato-lanceolato v. ovoideo, seminibus ellipsoideis nitidis.
*Hab.* Gaboon River and Corisco Bay, 1862, *G. Mann.*

6. A. LIMBATUM, sp. nov. Foliis oblongo-lanceolatis, acumine tenuiter caudatis, brevissime petiolatis v. sessilibus, subtus nervo medio atque margine brevissime ferrugineo pilosis, scapis brevibus 3-floris, fructu ovoideo, seminibus ellipsoideis nitidis.
*Hab.* Fernando Po, 1859 and 1861, *G. Mann.*

*c.* Flores parvi, lutei. Folia pilosa. Staminodia coadunata.

7. A. PILOSUM, sp. nov. Foliis elongato-lanceolatis acuminatis, breviter petiolatis, sparse pilosis, scapis brevibus bifloris, labello limbo transverse elliptico subcordato v. fere integro, fructu parvo obovoideo in tubo persistente perianthii repente contracto, seminibus perparvis transverse rugulosis.
*Hab.* Fernando Po, 1862, *G. Mann.*

*** *Scapi breves, obconici, capitati,* 10–15-*flori. Folia glabra.*

8. A. CITRATUM, *Pereira, Pharm. Journ. and Trans.* ix. 313 [*]. Foliis elongatis, oblongo- v. obovato-lanceolatis, breviter acuminatis, petiolatis, scapis crassis, bracteis superioribus margine crispatis, labello amplo erecto, fructu obovoideo limbo lato perianthii persistente continuo coronato, seminibus obscure angulatis tuberculatisque, apice breviter conico productis.
*Hab.* Gaboon River.

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[*] As no description of this species has yet been published, we include its diagnosis in the present paper.

## Note on the Embryo of *Ancistrocladus*. By G. Bentham, P.L.S., and J. D. Hooker, F.L.S.

[Read May 7, 1863.]

In the 'Genera Plantarum,' Part I. p. 191, we have fallen into an error in our description of the seed of *Ancistrocladus*, which error, as it affects the accuracy of the observations and drawings of so careful and excellent a botanist as Mr. Thwaites, which are published in our 'Transactions' (vol. xxi. p. 225. t. 24), we are desirous of correcting also in the Society's publications.

In the above-mentioned paper Mr. Thwaites describes the seed, from living specimens, as "Semen cerebriforme, erectum; testa plicato-intricata, albumen carnosum plicis involventi. Embryo orthotropus, clavatus; cotyledones subfoliacei, divergentes; radicula prope hilum posita."

When drawing up the generic character of *Ancistrocladus* for our work, we examined several seeds, and found their appearance to be not only as described by Mr. Thwaites, but so closely to resemble those of *Doona* and other *Dipterocarpeæ* (to which order we referred *Ancistrocladus* on other grounds), that we were led to suspect the accuracy of Mr. Thwaites's observation. Proceeding then to macerate the seeds, we found that in no case were we able to free the radicle from the supposed cotyledons, but that these appeared to be organically connected, whence we were led to describe what Mr. Thwaites called a ruminated albumen as contortuplicate cotyledons.

Mr. Thwaites, on receiving the 'Genera Plantarum' and observing our error, had the kindness to send to us ripe seeds of *Ancistrocladus* preserved in spirits, which clearly proved us to be in fault.

We may observe that this does not affect our view of the affinity of the genus being with *Dipterocarpeæ*, but adds one more to the already great proportion of exalbuminous Natural Orders in which albuminous genera occur.

Kew, May 5, 1863.

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## On the Identification of the *Acanthaceæ* of the Linnean Herbarium, in the possession of the Linnean Society of London. By T. Anderson, M.D., F.L.S., Officiating Superintendent of the Botanic Garden, Calcutta.

[Read April 2, 1863.]

Before leaving England for India in the beginning of 1861, I was able to devote some time to the examination of the *Acanthaceæ* existing in Linnæus's Herbarium, now the property of the Linnean Society. As the *Acanthaceæ* are eminently tropical, comparatively few species of the order were known to botanists of the time of Linnæus. Consequently the limits of the genera of the order were very indefinite—so much so, that many of the old genera are coextensive with the tribes or subtribes I have adopted in the rearrangement of the order. Indeed, the old genus *Ruellia* is equivalent to my Suborder *Ruellideæ*. Only five genera of *Acanthaceæ* are described in the 4th edition of the 'Genera Plantarum,' published in 1752, and, with the exception of *Thunbergia*, a genus of later date than 1752, these are the only genera recognized in Linnæus's Herbarium. The number of species is 67, distributed among the genera as follows:—*Thunbergia* 1, *Ruellia* 18, *Barleria* 9, *Acanthus* 11, *Justicia* 26, *Dianthera* 2.

There are, among these 67 species, representatives of 28 genera, according to the views I entertain of the limits of genera in this order; and many more, as will appear from the synonymy, if Nees von Esenbeck's opinions are adopted as he has stated them in the 11th volume of the 'Prodromus.'

The following list includes all the species referred to genera of *Acanthaceæ* by Linnæus, and specimens of which exist in his Herbarium. In preparing it for comparison, I have taken the names appended to the specimens by Linnæus as the basis of the arrangement, but in the sequence of the genera I have adopted my own arrangement. In the case of the Linnean names, I have quoted the work in which the species was first described. The name I adopt is then given.

A considerable array of synonymy occurs with some of the species; this is rendered necessary by my having quoted all those species of Nees von Esenbeck which I consider identical.

### THUNBERGIA, *Linn. fil.*

1. T. CAPENSIS, Thunb. Nov. Plant. Gen. p. 21. *T. Capensis*, N. ab E. in DC. Prodr. xi. p. 55, et mihi.—This plant bears the name of *Solandra Capensis* in Linnæus's Herbarium.

### RUELLIA, *Linn.*

1. R. BLECHUM, Linn. in Amœn. Acad. v. p. 400. *Blechum Brownei*, Juss. Ann. du Mus. ix. p. 270; N. ab E. l. c. p. 466, et mihi.—I refer Nees von Esenbeck's *B. Trinitense* and *B. Haenkei* to this species.

There is a second specimen in the Linnean Herbarium which is also called *R. Blechum*; it is probably an *Aphelandra*, but the species is not determinable.

2. R. CLANDESTINA, Linn. Sp. Pl. ed. 1753, ii. p. 634. *R. clandestina*, mihi. *Cryphiacanthus Barbadensis*, N. ab E. l. c. p. 197.—Nees von Esenbeck, at p. 156 of the 11th volume of the 'Prodromus,' gives *Cryphiacanthus clandestinus* as the name he adopts for Linnæus's *R. clandestina*, but that specific term does not occur among his species of *Cryphiacanthus*.

3. R. PANICULATA, Linn. Sp. Pl. ed. 1753, ii. p. 635. *R. paniculata*, mihi. *Dipteracanthus paniculatus*, N. ab E. l. c. p. 142.

4. R. TUBEROSA, Linn. Sp. Pl. ed. 1753, ii. p. 635. *R. tuberosa*, mihi. *Cryphiacanthus Barbadensis*, N. ab E. l. c. p. 197.—As appears by the synonymy, Nees von Esenbeck unites *R. clandestina* and *R. tuberosa*, Linn. Linnæus's specimens are certainly very distinct.

5. R. TENTACULA, Linn. in Amœn. Acad. iv. p. 320. *Haplanthus tentaculus*, N. ab E. l. c. p. 513, et mihi.

6. R. BIFLORA, Linn. Sp. Pl. ed. 1753, ii. p. 635, is an American species of *Calophanes*, but the specimen is too imperfect for identification. Nees von Esenbeck refers this to his *Calophanes oblongifolius*, DC. Prod. xi. p. 107.

7. R. CRISPA, Linn. Sp. Pl. ed. 1764, ii. p. 886. *Hemiagraphis crispa*, mihi.—*R. crispa*, N. ab E., is quite distinct from Linnæus's species, though Nees considers them identical. I have seen Nees von Esenbeck's species in Wight's Herbarium; it belongs to the small blue-flowered section of my remodelled genus *Hemiagraphis*. That section is very distinct from the yellow-flowered Strobilanthoid division of the genus, which contains species that are nearly all Eastern Asiatic or Malayan in their distribution, and may require to be separated generically from the blue-flowered Indian species.

8. R. REPANDA, Linn. Sp. Pl. ed. 1764, ii. p. 886. *R. repanda*, N. ab E. l. c. p. 144, et mihi.

9. R. RINGENS, Linn. Sp. Pl. ed. 1753, ii. p. 635. *Hygrophila salicifolia*, N. ab E. l. c. p. 92, et mihi.—This identification confirms Robert Brown's remark in the 'Prodromus Floræ Novæ Hollandiæ,' p. 479, under *Hygrophila angustifolia*. He says, "hujus congener et valde affinis est *Ruellia ringens*, Osb. et Linn. Sp. Pl. exclus. syn. Floræ Zeylanicæ et Rheed. Mal." The plant referred to by Linnæus in these works is probably *Ruellia prostrata*, Poir. Rheede's figure is not x. t. 64, as cited by Linnæus in the 'Flora Zeylanica' and the 'Species Plantarum,' but ix. t. 64.

10. R. ANTIPODA, Linn. Sp. Pl. ed. 1753, ii. p. 635, is *Bonnaya veronicæfolia*, Spreng.

11. R. REPENS, Linn. Mant. p. 89. *R. repens*, mihi. *Dipteracanthus lanceolatus*, N. ab E. l. c. p. 124.

12. R. LITTORALIS, Linn. Suppl. p. 289. *Calophanes littoralis*, T. Anders. in Thw. En. Pl. Zeyl. p. 225. *Dyschoriste littoralis*, N. ab E. l. c. p. 106.

13. R. DIFFORMIS, Linn. fil. Suppl. p. 299. *Adenosma triflora*, N. ab E. l. c. p. 68, et mihi.—Blume in the 'Bijdragen,' p. 804, refers this to his *Hygrophila difformis*. I have not seen Blume's plant, but it is probably a form of *Hygrophila salicifolia*.

14. R. BALSAMICA, Linn. Suppl. p. 289. *Adenosma balsamea*, Spr. Syst. ii. p. 829, et T. Anders. in Thw. En. Pl. Zeyl. p. 224.—The specific name is written "*balsamica*" in Linnæus's Herbarium.

15. R. ULIGINOSA, Linn. Suppl. p. 290. *Adenosma uliginosa*, N. ab E. in Wall. Pl. As. Rar. iii. p. 79, et DC. Prodr. xi. p. 69, et T. Anders. in Thw. En. Pl. Zeyl. p. 224.—Robert Brown in the 'Prodromus Fl. Nov. Holl.' can hardly be quoted as the authority for the species of *Adenosma*, as all the species indicated by him as belonging to it have been removed to *Scrophularineæ*.

16. R. PILOSA, Linn. Suppl. p. 290. *R. pilosa*, T. Anders. in Enum. Acanth. Afric. in Journ. Proc. Linn. Soc. vii. p. 25. *Fabria pilosa*, N. ab E. l. c. p. 114.—The species, however, in the Linnean Herbarium is by some error represented by what is evidently a species of *Antirrhinum*.

17. R. ALTERNATA, Burm. Fl. Ind. p. 135. *Hemiagraphis alternata*, mihi. *R. Blumeana*, et forsan *R. discolor*, N. ab E. l. c. p. 149.

18. *R.* species is *Stenandrium Pohlii*, N. ab E. l. c. p. 283, et mihi.

Two specimens included in the generic envelope of *Ruellia* in the Linnean Herbarium do not belong to the order Acanthaceæ; one is a species of *Phlox*, and the other is not determinable. A specimen marked "*Ruellia sp.* Linn. fil." is a species of *Phlox*; besides, there is a specimen of a *Ruellia* from North America in too imperfect a condition for identification.

## BARLERIA, *Linn.*

1. B. LONGIFOLIA, Linn. in Amœn. Acad. iv. p. 320. *Hygrophila spinosa*, T. Anders. in Thw. En. Pl. Zeyl. p. 225. *Asteracantha longifolia*, N. ab E. l. c. p. 247.

2. B. HYSTRIX, Linn. Mant. p. 89. *B. Prionitis*, Linn. Sp. Pl. ed. 1753, p. 636, et T. Anders. in Thw. En. Pl. Zeyl. p. 230. *B. Hystrix*, N. ab E. l. c. p. 239.

3. B. Prionitis, Linn. Sp. Pl. ed. 1753, p. 636. *B. Prionitis*, N. ab E. l. c. p. 237, et T. Anders. l. c.

4. B. buxifolia, Linn. Sp. Pl. ed. 1753, p. 636. *B. buxifolia*, N. ab E. l. c. p. 241, et mihi.—The specimen is marked from Ceylon. I have seen no other specimens from Ceylon. See note appended to this species at page 231 of Thwaites's Enum. Plant. Zeylan.

5. B. noctiflora, Linn. Suppl. p. 290. *B. noctiflora*, N. ab E. l. c. p. 239, et mihi.

6. B. cristata, Linn. Sp. Pl. ed. 1753, p. 636. *B. cristata*, N. ab E. l. c. p. 229, et T. Anders. in Thw. En. Pl. Zeyl. p. 230.—In Thwaites's Enumeratio Plant. Zeyl. I have placed *B. dichotoma* and *B. ciliata* of Roxburgh, as well as *B. Nepalensis* of Nees von Esenbeck, as synonyms of this species.

7. B. Indica.—This seems to be an unpublished name; the specimen bearing it is *B. cristata*.

8. B. pungens, Linn. Suppl. p. 290. *B. pungens*, N. ab E. l. c. p. 236, et mihi.

9. B. sericea.—*B. longiflora* is written in pencil on the sheet, and that is also the name under which the species was first published in the Supplement, p. 290. *B. longiflora*, N. ab E. l. c. p. 235, et mihi.

### Acanthus, *Linn.*

1. A. mollis, Linn. Sp. Pl. ed. 1753, p. 639. *A. mollis*, N. ab E. l. c. p. 270, et mihi.

2. A. carduifolius, Linn. Suppl. p. 294. *Blepharis carduifolia*, T. Anders. in Enum. Acanth. Afric. in Journ. Proc. Linn. Soc. vii. p. 35. *Acanthodium carduifolium*, N. ab E. l. c. p. 278.

3. A. spinosus, Linn. Sp. Pl. ed. 1753, p. 639. *A. spinosus*, N. ab E. l. c. p. 271, et mihi.

4. A. ilicifolius, Linn. Sp. Pl. ed. 1753, p. 639. *A. ilicifolius*, T. Anders. in Thw. En. Pl. Zeyl. p. 232. *Dilivaria ilicifolia*, (Juss.) N. ab E. l. c. p. 268.

5. A. Maderaspatanus, Linn. MSS. in Herb. *Blepharis molluginifolia*, (Juss.) N. ab E. l. c. p. 266, et T. Anders. in Thw. En. Pl. Zeyl. p. 231.—I am obliged to cite the Linnean specimen of this species in the manner I have done, because the name, though evidently suppressed on the sheet and transferred to Jussieu's *B. Boerhaaviæfolia*, has had no other substituted for it by Linnæus.

6. A. furcatus, Linn. Suppl. p. 295. *Blepharis furcata*, T. Anders. in Enum. Acanth. Afric. in Journ. Proc. Linn. Soc. vii. p. 35. *Acanthodium furcatum* et *A. macrum*, N. ab E. l. c. p. 276.

7. A. CAPENSIS, Linn. Suppl. p. 295. *Blepharis Capensis*, Pers. Syn. ii. p. 180, et mihi. *Acanthodium Capense*, N. ab E. l. c. p. 276.

8. A. MADERASPATENSIS, Linn. Sp. Pl. ed. 1753, p. 639. *Blepharis Boerhaaviæfolia*, Juss., N. ab E. l. c. p. 266, et T. Anders. in Thw. En. Pl. Zeyl. p. 231.

9. A. MADERASPATENSIS (?) is *Blepharis edulis*, Pers. Syn. ii. p. 180, et mihi. *Acanthodium spicatum*, (Delile) N. ab E. l. c. p. 274.

10. A specimen marked "A. 1." is *Hygrophila spinosa*, T. Anders. in Thw. En. Pl. Zeyl. p. 225. *Asteracantha longifolia*, N. ab E. l. c. p. 247.

11. "*Acanthus* ex Cap. Bon. Spei" is *Sclerochiton Harveyanus*, N. ab E. l. c. p. 279, et mihi.

### JUSTICIA, *Linn.*

1. J. ADHATODA, Linn. Sp. Pl. ed. 1753, p. 15. *J. Adhatoda*, (Linn.) T. Anders. in Thw. En. Pl. Zeyl. p. 233. *Adhatoda Vasica*, N. ab E. l. c. p. 387.

2. J. ECBOLIUM, Linn. Sp. Pl. ed. 1753, p. 15. *Eranthemum Ecbolium*, T. Anders. in Thw. En. Pl. Zeyl. p. 235. *J. Ecbolium*, N. ab E. l. c. p. 426. *J. gymnostachya*, N. ab E. l. c. *J. lætevirens*, (Vahl) N. ab E. l. c. p. 427. *J. strobilifera*, (Lam.) N. ab E. l. c. *J. emarginata*, N. ab E. l. c. *J. rotundifolia*, N. ab E. l. c. *J. syringifolia*, (Vahl) N. ab E. l. c. *J. livida*, (Wall.) N. ab E. l. c. *J. dentata*, (Klein) N. ab E. l. c. —Linnæus's specimen of this species is a cultivated one from the Upsal Botanic Garden.

3. J. ECBOLIUM, Linn. (No. 2.)—This is probably *Aphelandra tetragona*, N. ab E. l. c. p. 295, but the specimen is too imperfect for specific identification.

4. J. PULCHERRIMA, Linn. Suppl. p. 84. *Aphelandra pulcherrima*, (H. B. K.) N. ab E. l. c. p. 295, et mihi.

5. J. PICTA, Linn. Sp. Pl. ed. 1762, p. 21. *Graptophyllum hortense*, N. ab E. l. c. p. 328, et mihi.

6. J. INFUNDIBULIFORMIS, Linn. Sp. Pl. ed. 1762, p. 21. *Crossandra infundibuliformis*, N. ab E. l. c. p. 280, et mihi.—*C. axillaris* et *C. oppositifolia*, N. ab E., cannot be considered good species; I therefore include them under *C. infundibuliformis*.

7. J. FASTUOSA, Linn. Mant. p. 172. *Hypoestes fastuosa*, (Soland.) N. ab E. l. c. p. 507, et mihi.

8. J. GENDARUSSA, Linn. Suppl. p. 85. *J. Gendarussa*, T. Anders. in Thw. En. Pl. Zeyl. p. 233. *Gendarussa vulgaris*, N. ab E. l. c. p. 410.

9. J. TRANQUEBARIENSIS, Linn. Suppl. p. 85. *J. Tranquebariensis*, mihi. *Adhatoda Tranquebariensis*, N. ab E. l. c. p. 399.

10. J. HYSSOPIFOLIA, Linn. Sp. Pl. ed. 1753, p. 15. *J. hyssopifolia*, (Linn.) T. Anders. in Enum. Acanth. Afric. in Journ. Proc. Linn. Soc. vii. p. 41. *Adhatoda hyssopifolia*, N. ab E. l. c. p. 392.—Nees von Esenbeck has confused *J. hyssopifolia* and *J. cuneata*, Vahl (*Adhatoda*, N. ab E.), and has therefore cited some of the specimens of *J. cuneata*, a truly Cape of Good Hope species, under the name *J. hyssopifolia*. *J. hyssopifolia* has not been found on the continent of Africa.

11. J. ACAULIS, Linn. Suppl. p. 84. *Elytraria crenata*, (Vahl) N. ab E. l. c. p. 63, et mihi.—Palisot de Beauvais's West African species, *E. marginata*, and the North American *E. virgata*, N. ab E., with the synonymy quoted by Nees, both belong to this species, for which I retain Vahl's specific name.

12. J. CILIARIS, Linn. Suppl. p. 84. *Schwabea ciliaris*, N. ab E. l. c. p. 384, et T. Anders. in Enum. Acanth. Afric. in Journ. Proc. Linn. Soc. vii. p. 45.

13. J. PROCUMBENS, Linn. Fl. Zeyl. p. 7. *J.* (sect. *Rostellaria*) *procumbens*, (Linn.) mihi. *Rostellaria procumbens*, N. ab E. l. c. p. 371. *R. rotundifolia*, N. ab E. l. c. p. 370. *R. Abyssinica*, (Brongn.) N. ab E. l. c. p. 372. *R. mollissima*, N. ab E. l. c. p. 373. *R. Royeniana*, N. ab E. l. c. *R. crinita*, N. ab E. l. c.

14. J. DIFFUSA, Sm. MSS.—This specific name is not in Linnæus's handwriting, but in that of Sir James Smith. The species is *Lepidagathis hyalina*, N. ab E. l. c. p. 252.

15. J. PECTINATA, Linn. Amœn. Acad. iv. p. 299. *Rungia pectinata*, N. ab E. l. c. p. 470, et mihi. *R. parviflora*, N. ab E. l. c. et T. Anders. in Thw. En. Pl. Zeyl. p. 234. *R. polygonoides*, N. ab E. l. c. p. 471. *R. origanoides*, N. ab E. l. c. *R. muralis*, Royle, N. ab E. l. c. p. 470.

16. J. REPENS, Linn. Sp. Pl. ed. 1753, p. 15. *Rungia repens*, N. ab E. l. c. p. 473, et T. Anders. in Thw. En. Pl. Zeyl. p. 235.

17. J. CHINENSIS, Linn. Sp. Pl. ed. 1753, p. 16. *Dicliptera Chinensis*, N. ab E. l. c. p. 477, et mihi. *D. Burmanni*, N. ab E. l. c. p. 83. *D. Roxburghiana*, N. ab E. l. c.

18. J. ECHIOIDES, Linn. Sp. Pl. ed. 1753, p. 16. *Andrographis echioides*, N. ab E. l. c. p. 518, et T. Anders. in Thw. En. Pl. Zeyl. p. 232.

19. J. SEXANGULARIS, Linn. Sp. Pl. ed. 1753, p. 16. *Dicliptera sexangularis*, (Juss.) N. ab E. l. c. p. 479, et mihi.

20. J. ASSURGENS, Linn. Amœn. Acad. v. p. 391. *Dicliptera assurgens*, (Juss.) N. ab E. l. c. p. 489.

21. J. NASUTA, Linn. Sp. Pl. ed. 1753, p. 16. *Rhinacanthus communis*, N. ab E. l. c. p. 442, et T. Anders. in Thw. En. Pl. Zeyl. *R. Rottlerianus*, N. ab E. l. c. p. 443.

22. J. BIVALVIS, Linn. Sp. Pl. ed. 1762, p. 23. *Dicliptera bivalvis*, (Juss.) N. ab E. l. c. p. 475, et T. Anders. in Thw. En. Pl. Zeyl. p. 235.

23. J. PURPUREA, Linn. Sp. Pl. ed. 1753, p. 16. *Hypoestes purpurea*, (R. Br.) N. ab E. l. c. p. 509, et mihi.—This species has not been found in India. Griffith's specimen in the Hookerian Herbarium, quoted by Nees von Esenbeck in the 'Prodromus' as from Assam, is a cultivated specimen from the Calcutta Botanic Garden, into which the plant was introduced from China by Mr. Reeves in 1820. The specimen in the Linnean Herbarium is also from China.

24. J. GANGETICA, Linn. Amœn. Acad. iv. p. 299. *Asystasia Gangetica*, T. Anders. in Thw. En. Pl. Zeyl. p. 235. *A. Coromandeliana*, N. ab E. l. c. p. 165. *A. plumbaginea*, N. ab E. l. c. p. 164. *A. quaterna*, N. ab E. l. c. p. 166. *A. intrusa*, N. ab E. l. c. *A. Bojeriana*, N. ab E. l. c. *A. Comorensis*, (Bojer) N. ab E. l. c. *A. calycina*, Benth. Fl. Nig. p. 478, non N. ab E.—I appended the following note to this species in Thwaites's Enumeratio Plantarum Zeylaniæ, p. 236:—"The extensive distribution of this species over tropical Asia and Africa renders the specific name adopted by Nees von Esenbeck quite inappropriate, and the same objection may be made to the original one given by Linnæus, and which, as being the oldest, I have revived. For so cosmopolitan a plant the specific term *communis* or *vulgaris* would perhaps be more suitable."

25. J. BICALYCULATA, Vahl. This specimen has not a Linnean specific name attached. In the Supplement, p. 85, it is described under the name *Dianthera Malabarica*.

26. A specimen named *J. hyssopifolia*, and on another portion of the sheet having *J. antidota*, written by Sir J. Smith, is *J. Betonica* var. *Neilgherriensis*, mihi; *Adhatoda Nilgherrica*, N. ab E. l. c. p. 386. The *J. hyssopifolia* of the 1st edition of the 'Species Plantarum' is a native of the Canary Islands.

### DIANTHERA, *Linn.*

1. D. AMERICANA, Linn. Sp. Pl. ed. 1753, p. 27, is a species of *Rhyttiglossa*, probably the *R. pedunculosa*, N. ab E. l. c. p. 339.

2. D. COMATA, Linn. Sp. Pl. ed. 1762, p. 24. *Leptostachya comata*, N. ab E. l. c. p. 381.

The specimen marked *Eranthemum hyssopifolium* does not belong to the order Acanthaceæ.

# On *Anisostichium*, a proposed new Genus of *Musci*.

## By WILLIAM MITTEN, A.L.S.

[Read June 18, 1863.]

### ANISOSTICHIUM, gen. nov.

Foliis inæqualibus, diversiformibus, uno latere majoribus distichis, altero minoribus stipuliformibus; florescentia terminali fructuque *Weberæ*.

1. A. TOZERI. Foliis tristichis, majoribus patulis verticaliter subplanis, minoribus suberectis lanceolatis ovato-lanceolatisve.

*Bryum Tozeri*, Greville, Scot. Crypt. Fl. v. t. 285.

*Hab.* In Britannia Galliaque australi, India orientali temperata, et in insulis Sardiniæ, Madeiræ, et Javæ.

Fig. 3. A sterile stem, magnified.

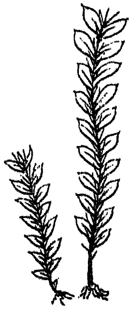

Fig. 1 (A. pictum).

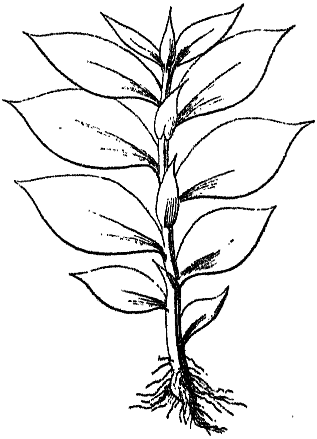

Fig. 3 (A. Tozeri).

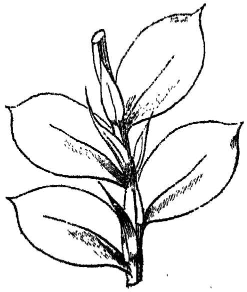

Fig. 2 (A. pictum).

2. A. PICTUM, sp. nov. Caulibus elongatis, foliis majoribus patentibus verticaliter complanatis late obovatis apice apiculatis submarginatis integerrimis nervo infra apicem evanido, minoribus tristichis erectis ovato-lanceolatis nervo breviore cellulis laxis elongatis pellucidis.

*Hab.* In Jamaica (*Hb. Hooker.*), Veraguas (*Dr. Seemann*), et in America fœderata australiore.

Fig. 1. Stems, of the natural size. Fig. 2. A portion magnified.

Leaves pale green, the older ones as well as the stems becoming beautifully tinged with red. Rudiments of inflorescence are alone observable on the specimens from Jamaica, and these occur on stems having the same arrangement of leaves as in those which are barren. In *A. Tozeri* the leaves of the fertile stems show but indistinctly the tristichous arrangement sufficiently evident in the sterile.

This genus occupies a place in the group of Mosses which correspond in areolation and fructification with *Bryum*, and constitute the tribe *Bryaceæ*; it is closely allied to *Webera*, with which its fruit agrees; but it differs from all other genera yet known to belong to that group in the same manner as *Calomnion* does from *Hymenodon* and other *Mniaceæ*. If the arrangement of the leaves alone was a sufficient character to form a genus, *Anisostichium Tozeri* would exactly correspond with *Calomnion*; but the areolation of the latter is composed of rounded hexagonal cells, and is precisely that of *Rhizogonium*, which so closely simulates the forms of *Mnium*, that they must all be referred to the same natural group—*Mniaceæ*. The analogy of form is carried still further in *Mniopsis*, which has barren and fertile stems with their leaves disposed as in corresponding stems of *Schistostega*; but the areolation is distinctly Mnioid, whilst *Schistostega* has the areolation observable in *Anisostichium* and *Webera*, and thus is more nearly allied to them, and belongs to the *Bryaceæ*,—there being no connecting link between it and the *Splachnaceæ*, to which Schimper, although instituting for its reception his family *Schistostegeæ*, is inclined to refer it.

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## On the Ink-plant of New Granada (*Coriaria thymifolia*). By Dr. William Jameson, of Quito; in a Letter to I. A. Henry, Esq. (Communicated by J. D. Hooker, M.D., F.R. & L.S.)

[Read June 18, 1863.]

"Quito, April 11, 1863.

"I am anxious to have Dr. Hooker's opinion of the 'Ink-plant.' There is a tradition here respecting this vegetable juice that merits attention. It happened, during the Spanish Administration, that a number of written documents, destined to the mother country, were embarked in a vessel, and transmitted round the Cape. The voyage was unusually tempestuous, and the documents got wetted with salt water. Those written with common ink became nearly illegible, whereas those written with 'Chauchi' (the name of the juice) remained unaltered. A decree was thereupon issued that the Government communications should in future be written with the vegetable juice....I do not vouch for the correctness of this statement, but I have constantly heard it repeated from different sources. I generally use this ink in preference to the commercial article, as it is not so apt to corrode the steel pen. The present note is written with it, and has no admixture whatever, being only yesterday expressed from the fruit. When newly written, its colour is reddish, becoming black after a few hours."

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## A Description of some remarkable Malformations affecting the Genus *Lolium*. By MAXWELL T. MASTERS, M.D., F.L.S., Lecturer on Botany, St. George's Hospital.

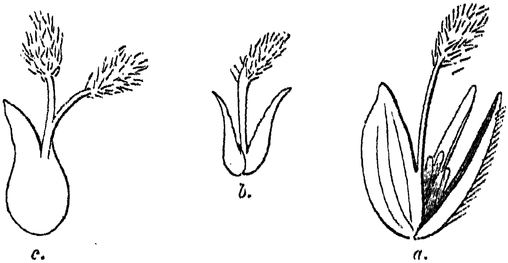
[Read March 19, 1863.]

IN the volume of the Bull. Soc. Bot. Fr. for the year 1858, p. 85, M. Fournier has described four varieties of *Lolium perenne* as of common occurrence, and in a paper in Seemann's Journal of Botany, vol. i. p. 6, I have mentioned certain others. The specimens I have now the honour of laying before the Society must be classed under the head of Deformities rather than that of Varieties.

The simplest of the changes now to be mentioned consists merely in the lengthening of the axis of the spikelet, in consequence of which, the constituent florets are separated by much longer intervals than usual. In some examples of this, the axis is not merely lengthened, but becomes very flexuose, while the outermost glume only just exceeds the lowermost floret in length, and is very short in proportion to the length of the spikelet; hence the aspect of the plant is very different from that of the natural form. This change may occur independently of any other; but I have most frequently met with it in the branched variety, common under the several names of *L. perenne compositum*, *paniculatum*, or *ramosum*. Usually only a few of the spikelets are so affected; but in the plant now shown all the spikelets are thus changed.

In another series of specimens I have met with the following changes:—The spikelets have assumed more of a rounded outline than usual, and are shorter than the outer glume. The number of florets is in general reduced to three, in each of which, or sometimes in the lower one only, considerable changes have taken place. The paleæ are for the most part unchanged; but in some of the spikelets the inner palea is placed opposite to the outer one, and on the same level with it, while in others the inner palea is split into two, thus rendering the symmetry of the whorl complete (fig. 1, *a*). Within the paleæ, in place of the stamens and pistils is a confused mass, consisting of numerous scales, the outermost of which resemble paleæ, and are frequently more or less recurved or hooklike at their points; the inner ones are smaller, and either merely white and membranous like the ordinary lodicles, or they exhibit various intermediate stages between the state of scales and that of feathery stigmata (fig. 1, *b*, *c*). I have not been enabled to discover, in any of the very numerous specimens examined, the slightest trace either of stamens or of ovules.

Fig. 1.



*a*. Floret showing outer palea partially stigmatic; inner palea partly divided into two, and enclosing a number of scales. *b*, *c*. Inner scales from florets, showing tendency to assume appearance of the pistil.

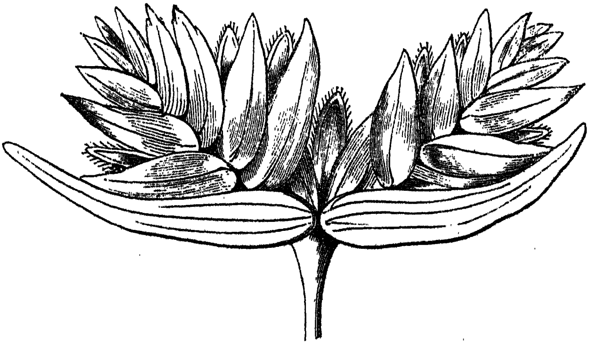
To sum up the peculiarities afforded by these specimens, it may be said that they present a diminished number of florets, an alteration in the form of the spikelet, a change in the number and disposition of the paleæ, a partial chloranthic condition of the inner constituents of the florets, a multiplication of these constituents, and a tendency in them to assume the nature of the pistil.

In a third series of specimens the changes that have taken place are yet more grave and singular. In the lower part of the spike the spikelets are of the ordinary form, and are arranged singly and alternately on the sides of the grooved rachis; but towards the upper part of the spike a change in the disposition takes place, and the spikelets become arranged in pairs on each notch of the rachis, as they are in *Elymus* or *Hordeum*, the pairs being arranged alternately as usual, but in four or more rows instead of in two.

The spikelets themselves are more or less spherical in form, each has an outer and inner glume of the ordinary aspect, and is made up of a number of florets arranged, not in two rows, but in several, and, owing to the shortening of the rachis of the spikelet, they are densely tufted. So closely are the florets crowded, that in many instances a fusion of the outer paleæ of two contiguous florets has taken place. This double palea shows eleven ribs, five on each half, and a central one in the line of fusion.

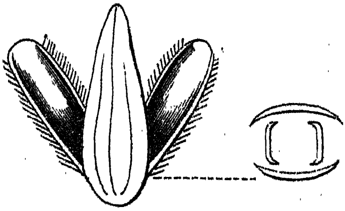
The union sometimes extends also to the inner paleæ; and in one case the inner pales of three florets were united together. Within the paleæ may here and there be found a perfect flower; but more usually there are a number of scales, the outer ones palea-like, often twisted spirally, and hooked at the summit; the succeeding ones exhibit various intermediate conditions between that of palea and that of stamens, while the central ones are merely rudimentary scales. The lodicles are not distinguishable from these latter; and, contrary to what happens in the second series of specimens now described, in the present instance there is no trace of pistil, except in the case immediately to be described. In addition to the changes just mentioned, the axis of the spikelet just within the outer glumes occasionally divides into two diverging branches, each bearing its tuft of florets (fig. 2). In the fork between the two branches is placed in some, but not in all, a single floret, which thus terminates the main axis of the spikelet, after the fashion followed in a dichotomous cyme. The component parts of this floret are arranged after a different method from the ordinary one (fig. 2 *a*). The outer whorl consists

Fig. 2.



Branching of axis of spikelet within the outer glumes.

Fig. 2 *a*.



Central, terminal floret, and plan of the same.

of two paleæ, placed directly opposite one another, and quite resembling in form and appearance the ordinary outer palea. Within these, and at right angles to them, are two more segments, precisely resembling the inner paleæ of the natural flower; within these, again, are a number of thin membranous scales, some of them having more or less of the appearance of the stigmata.

Thus in these very curious specimens the following changes, or some of them, may be observed:—

1st. An alteration in the form of the spikelets, whereby they become spheroidal.

2ndly. Their arrangement in pairs instead of singly on each notch of the rachis, and also in more than two vertical rows.

3rdly. The disposition of the florets in close tufts or whorls; in consequence of which, 4thly, the outer and inner paleæ become more or less fused together.

5thly. Multiplication of the inner portions of these florets, and their presence in the form of scales, exhibiting transitional stages between the scales and stamens.

6thly. Bifurcation of the axis of the spikelet; and, 7thly, the occasional presence of a floret of peculiar construction in the angle of divergence of the two branches.

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## Account of the Botanical Collections made by DAVID LYALL, M.D., R.N., F.L.S., Surgeon and Naturalist to the North American Boundary Commission.

[Read June 18, 1863.]

THE plants upon which the following observations were made, and of which a complete systematic catalogue is appended, were collected in the years 1858–1861, during which period I was, firstly, Surgeon of H.M. Surveying-ship 'Plumper,' and afterwards Surgeon and Naturalist to the Commission appointed to mark out the boundary-line between the British Possessions and those of the United States of America, to the westward of the Rocky Mountains.

The dried plants were transmitted from time to time, as collected and preserved, to Sir William Hooker, at the Royal Gardens at Kew. Of these, the earlier collections were provisionally arranged and catalogued soon after their arrival by Mr. Black, the Curator of the Herbarium; my later and more extensive collections, together with those that followed me to England, were retained intact until such time as I should receive authority from Her Majesty's Government to complete the arrangement of the whole and prepare the accompanying report upon the botanical results of the Boundary Commission.

The necessary arrangements having been made which enabled me to repair to Kew, I immediately commenced the sorting and ticketing of the specimens in all the collections, previous to throwing them together into one complete classified Herbarium and comparing them with the rich North American Herbarium of Sir William Hooker, which, from its containing the plants of every previous explorer of British North America, named in accordance with that celebrated botanist's 'Flora Boreali-Americana,' offered facilities for such a comparison that no other botanical establishment possesses.

The collections having been accurately and, indeed, authentically named, and a complete set laid into the Hookerian Herbarium, I distributed the duplicates to various public museums and botanists in Europe and North America, as well as India and Australia—those having been selected in which (according to the authorities at Kew) they would be most beneficial to science. In doing this, I attached to every specimen a ticket, bearing the same name, locality, &c., as that attached to the specimens retained in the Herbarium at Kew. This done, I drew up the report as follows.

The collections contained 1375 species, of which upwards of 6700 specimens were distributed, not including in the number of the latter the Algæ, Mosses, Hepaticæ, or Lichens. Of the latter order sixty sets are made up, ready for distribution. The others were made up into sets as far as the duplicates of each species would allow, and sent to the following Herbaria:—

Dr. Asa Gray, Cambridge University, Massachusetts.
Musée d'Histoire Naturelle, Paris.
Royal Herbarium, Berlin.
Herbarium, Botanical Gardens, St. Petersburg.
Imperial Herbarium, Vienna.
Professor N. J. Anderson, Stockholm.
Professor Grisebach, Göttingen.
Herbarium, Trinity College, Dublin.
M. Boissier, Geneva.
Royal Herbarium, Leyden.
Professor Bungé, Dorpat.
Dr. Lindley, F.R.S.
John Ball, Esq., F.R.S.
Royal Herbarium, Calcutta.
Royal Herbarium, Munich.
Professor Fries, Upsal.
Professor O. Heer, Zurich.
Dr. Mueller, F.R.S., Melbourne.

This appears to me to be the proper place in which to record the obligations which Sir William Hooker has conferred, in his public capacity, upon science, and, in a private one, upon myself, for whatever value the results of my labours may possess. The attachment of a botanist to the Boundary Commission was due to his powerful representations to Her Majesty's Government; and I owe my own appointment to that office to his friendship and the kind offices of Admiral Washington, the Hydrographer of the Admiralty.

During the whole progress of the expedition I was honoured and stimulated by Sir William's encouraging correspondence, and on my return he allowed me the free use of the noble Herbarium at Kew for the purposes above detailed.

During the time that I was employed at Kew, and indeed previous to that, as far as regards the classification of my earlier collections, I received the most cordial and essential aid from Mr. A. Black, A.L.S., Curator of the Herbarium, but for whose extensive knowledge of American botany and its literature, and intimate acquaintance with the plants in the Herbarium, I could not have named my collections with that accuracy which, thanks to his exertions, may now be confidently claimed for them.

To my old friend Professor Harvey, F.R.S., of Dublin, the distinguished Algologist, I am indebted for the examination and description of the Algæ, an account of which will be found in the 6th volume of the Linnean Society's Journal.

I have been fortunate in securing the services of Mr. William Mitten, A.L.S., in the arrangement and naming of my extensive collections of Mosses, Hepaticæ, and Lichens, which thus have the value of being named by one of the most able and assiduous Cryptogamists in England. Mr. Mitten further intends to draw up an account of them for publication.

A large collection of Fungi was formed, and preserved principally in saline solution. These, it was hoped, would have enabled some botanist in that obscure and difficult department to have thrown some light on the species of North-west America; but the Rev. M. J. Berkeley, F.L.S., to whom they were submitted, states that they have had their distinctive features so much altered as to render them unfit for description.

I should be ungrateful did I omit to mention here also how much indebted I am for the kind support which I received from Lieut.-Col. Hawkins, R.E., Her Majesty's Boundary Commissioner, throughout the expedition *, as well as from my old friend Captain G. H. Richards, R.N., of Her Majesty's Surveying-ship the 'Plumper,' during the few months that I had the pleasure of serving on board that vessel.

The summer of 1858 was spent partly on board the 'Plumper,' at the south-east corner of Vancouver Island and amongst the islands in the Gulf of Georgia, and partly with a detachment of men belonging to the Boundary Commission in the Fraser River Valley, west of the Cascade Mountains, and a little more than twenty miles from the sea.

The summer of 1859 was passed in the same localities as above mentioned, and on the western slope of the Cascade Mountains, close to the 49th parallel.

In May 1860 the Columbia River was entered, and in that season collections were made on both sides of the river, from the Dalles (where our party was divided into two) up to the 49th parallel, and from the summits of the Cascade Mountains as far east as Colville, where the winter-quarters of the expedition were located.

In 1861 parties were pushed forward to the eastward as far as the watershed of the Rocky Mountains (the extreme point to which the Boundary-line had to be run), whence an opportunity was afforded us of paying a hurried visit to the plains at the eastern base of the mountains, as well as of forming collections in their more elevated regions.

### *General character of the Regions traversed.*

Immediately on the 49th parallel (with the exception of the bare Cascade Mountain tops) there is no interruption to the forest from the Gulf of Georgia to the Similkameen valley, on the east side of the Cascade Range. Here, trees not met with on the other side make their appearance, and the country becomes more open, grass in greater or less luxuriance being common under the trees, which in some places disappear almost entirely, as in a great part of the Similkameen valley and the country near Lake Osoyoos, on the hills as well as in the valleys. Indeed, on arriving at the watershed of the Cascade Mountains, a marked difference is observed in this respect. To the westward there is no grass nor food for animals to be found in the forest on the line of march from the Chilukweyuk prairie, near the Fraser River, to the summit of the mountains; on account of which, a great proportion of the loads carried by horses and mules travelling this way must necessarily consist of grain for themselves. The only exception to this dearth of fodder is that near the Chilukweyuk Lake, which is at an altitude of 2052 feet above the sea-level, are some wet and swampy green spots, of small extent and destitute of trees. These are called 'wet prairies,' and are covered chiefly with Gramineæ, Cyperaceæ, and Equisetaceæ, all of very luxuriant growth, and in sufficient quantity to feed a small number of animals, which greedily devour the latter especially, in spite of their siliceous coats. In winter, at times when the grass is deeply covered with snow, the Equisetaceæ, growing under the fringe of trees and bushes bordering the streams, form the principal food of such horses and mules as are unfortunate enough to have to trust entirely to nature for their supplies. As soon as the eastern slope of the Cascades is attained, all difficulty about fodder for animals ceases, and parties may travel from thence to the Rocky Mountains without grain for their beasts of burden. At the same time, with a large organized party like ours, where the mules were kept constantly on the move as long as the ground could be travelled over for snow, there is a short part of the route, between Sinyakwateen on the Pend Oreille River, and Chelemta on the Kootenay, where, on account of the comparative scarcity of grass, especially in autumn, it was considered advisable to pack a certain quantity of grain for the animals, in order to preserve them in full strength and vigour.

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* Sapper John Buttle, R.E. (who underwent a training at Kew before the expedition left England), was excused from his regular duties whenever required to assist me in collecting and preserving specimens, &c., and was found a useful assistant.

Eastward from the valley of the Similkameen the country is generally grassy, with hills of moderate elevation, for a distance of sixty or seventy miles. At the point where the Nehoialpitq River bends suddenly to the southward to join the Columbia, a mountainous region commences. Indeed, from this, all the way to the Rocky Mountains, along the 49th parallel, there is nothing but a succession of steep mountain-ranges, with some narrow valleys and ravines between, and the country altogether is so rugged, that any traveller proceeding from the Similkameen to the Boundary Pass in the Rocky Mountains must necessarily go as far south as the Spokan valley, in about lat. 47° 50′ N., to enable him to accomplish his object.

To return to the west side of the Cascade Mountains: the work there having been finished as far as Roche River, in the heart of the range, it was found necessary, in consequence of the difficulty and time that must have been expended in transporting such a large party across the Cascades, to ascend the Columbia River in order to get to the eastward of those mountains. This was done in steamers as far as the Dalles. Here the party divided, one portion proceeding up the west side of the river, in a northerly direction, by Fort Simcoe, across the Natchess and other tributaries of the Yakima, and across the Upper Yakima River, striking the Columbia again a little below the Wenatchee; from this the trail ran along (still northwards) near the Columbia until it reached the Okanagan valley, up which it led to the Lake Osoyoos. Here the party struck off to the north-west up the Similkameen valley, and on arriving at the Ashtnolo, a mountain-torrent, ascended the ravine through which it runs, and taking the tributary which led most directly to the southward, got close to the 49th parallel, in long. 120° W. The station here was 5480 feet above the sea, and about 2020 feet below the mountain-summits, the access to which was easy. From this point a party proceeded westward to Roche River, thus connecting the Survey with that of the preceding year from the west side of the Cascades.

The route from the Dalles which has just been mentioned, and along which collections were made, crosses several spurs of the Cascades, and the rivers named below the Okanagan have their sources in those mountains, and a short course from thence to the Columbia.

Returning to the Dalles: the other branch of the party kept on the left bank of the Columbia, from the Dalles to Walla Walla, and from thence proceeded northwards to the Snake River, which was crossed where it receives the Peloose. From that they went by the 'Big Lake' nearly due north to Colville, on the banks of the Columbia River.

Nearly the whole of this route was over an arid, comparatively barren and treeless region. Collections were here made at different points by Sapper Buttle.

In the summer of 1861 the line of country in which botanical collections were made ran southwards up the Colville valley, and then through a partially wooded country to the Spokan valley, a great part of which is destitute of trees, and partakes somewhat, in its productions, of the character of the barren grounds of the Columbia. Proceeding in a north-easterly direction, the trail next leads to the Pend Oreille River, which is here densely wooded on both sides, but has, in some places, between the forest and the river, pretty extensive meadow-grounds, which, in June, at the height of the floods caused by the melting of the snow in the mountains, are almost entirely covered with water. From Sinyakwateen, the crossing-place at the Pend Oreille River, the trail runs through a gloomy and almost grassless forest for about twenty or five-and-twenty miles to the Pack River, from whence to the Kootenay the forest is more open.

Along the valley of the Kootenay which we ascended the forest is in most places open, with no scarcity of grass on the right bank. The valley above the place where crossed is very narrow, with steep hills in some places rising abruptly from the river. Above the second crossing of the Kootenay at its south-east bend, and on approaching the Tobacco Plains, the river-banks become more rugged and thickly timbered and grass more scarce, until, suddenly, what was nothing more than a ravine opens out into a wide, almost treeless valley, with many of its plants similar to those of the dry grounds of the Columbia. The trail leading to the Boundary Pass of the Rocky Mountains merely crosses the lower corner of this open valley and enters shortly amongst the Galton Mountains, a range lying between the Kootenay and Flathead Rivers, and rising to an altitude of about 8000 feet above the sea. Crossing by a pass, which on the 17th of July had snow upon it, the trail runs down the eastern slope of the Galton Mountains to the Flathead River, which, at the place where it was forded, was found to be 4005 feet above the sea. The valley of the Flathead is partly clear of trees, and again affords indications of a comparatively dry climate. Immediately on crossing this valley, the Pass of the Rocky Mountains is entered upon. The ascent is at first very gradual until, in the very centre of the range, a steep hill comes in the way, the pass over which was found to be 6970 feet above the sea, wooded on both sides and with scattered stunted trees on the top. On the east side of this hill there is a steep descent to a glen which leads out by a comparatively gentle decline to the Buffalo Plains of the Saskatchewan. These plains, close to the foot of the mountains (the termination of which is very abrupt), are about 5000 feet above the sea.

The camp of the astronomical station on the Rocky Mountains was at an altitude* of 6480 feet, close to the 49th parallel; and from this the slaty summits of the mountains (8386 feet above the sea) could be reached, affording an excellent opportunity of forming a complete collection of the vegetation of this elevated region.

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* The altitudes given are from observations made by Mr. Bauerman, the Geologist of the expedition.

The longitude of the watershed, as determined by Captain Haig, is 114° 2′ 49″ W.

### *Botanical Aspects of the Regions traversed.*

The harbours of Victoria and Esquimalt, at the south-east corner of Vancouver Island, in the immediate neighbourhood of which most of the plants collected in that island were found, are about three miles distant from each other, although one of the arms of the former is within a few hundred yards of Esquimalt. The country around them is rocky, in some places covered with pine forests, in others open and park-like, and more or less studded with oaks (*Quercus Garryana*, Doug.).

Around the shores of Esquimalt the following trees occur, viz.:—

Pinus contorta, *Doug.*
Abies Douglasii, *Lindl.*
—— Menziesii, *Lamb.*
Thuja gigantea, *Nutt.*
Taxus baccata, *L.*
Arbutus Menziesii, *Pursh.*
Cerasus mollis, *Doug.*
Quercus Garryana, *Doug.*

*Arctostaphylos tomentosa* is found on hills to the westward of the harbour. Species of *Acer*, *Betula*, *Alnus*, and *Salix* are plentiful. Among the more common shrubs are species of *Mahonia*, *Ceanothus*, *Acer*, *Nuttallia*, *Spiræa*, *Rubus*, *Rosa*, *Ribes*, *Vaccinium*, *Salix*, *Gaultheria*, &c.

Amongst the most conspicuous flowering-plants met with there in the early part of the season are several species of *Ranunculus*, of *Claytonia*, of *Potentilla*, and of *Saxifraga*, *Plectritis congesta*, *Collomia gracilis*, *Collinsia violacea*, *Dodecatheon Meadia*, *Sisyrinchium grandiflorum*, species of *Fritillaria*, *Camassia esculenta*, and species of *Trillium*.

The country gone over on the mainland may, for the convenience of botanical comparison, be, with propriety, divided into three principal regions:—

1st. The Lower Fraser River district, which includes the Sumass and Chilukweyuk prairies and other low grounds to the westward of the Cascade Mountains—a moist region.

2nd. The Columbia valley between the Dalles and Colville—a dry country, for the most part destitute of trees.

3rd. The higher regions of the Cascade and Rocky Mountains—regions of moisture.

The country intersected by the Boundary-line between the Cascade and Rocky Mountains partakes of the character of all these three regions. At the Colville River valley, and in the

Pend Oreille valley, we have an under-vegetation resembling in many of its features that of the Lower Fraser; whilst the productions of the Similkameen valley and the Tobacco Plains, and part of the Flathead valley, approximate to those of the dry region of the Columbia.

Such of the intervening mountain-ranges as we had an opportunity of examining afford specimens of alpine plants the same as were obtained on the Cascades and Rocky Mountains.

With reference to the *first* district, it may be mentioned that the line of separation between Washington Territory and British Columbia for the first twenty-five miles from the sea runs nearly parallel to the Fraser River, and at an average distance of less than ten miles from it. About twenty-four miles inland it strikes one of the spurs of the Cascades. Up to this point the ground is nearly level, but little above the sea, and densely timbered with trees mentioned below.

The Lower Fraser River has along its left or south bank a range of low rocky hills, extending from Langley to the mouth of the Sumass River; and to the southward of these, between them and the spur of the Cascades just mentioned, lies the Sumass prairie. Nearly in the middle of this prairie is the lake of the same name, about ten miles long by four broad at its widest part. During the season of flood it extends from hill-foot to hill-foot, and even after the subsidence of the waters its mud-banks or beaches reach certain points on both sides.

The larger half of the prairie is at the south-west end of the lake, and is (roughly) about four miles square.

The prairie-ground at the north-east end of the lake is bounded by a belt of trees separating it from the clear or prairie ground on the banks of the Chilukweyuk River. The clear ground on both sides of this river has been apparently formed partly by the repeated action of fires, destroying the trees which at one time grew on the higher banks, and partly by the action of the annual floods which overflow a large portion of it.

Most of the collections made in the first district were from the Sumass and Chilukweyuk prairies and from the comparatively low adjoining hills.

These (so-called) prairies have, during the season of flood, more the appearance of immense lakes, being, with the exception of a higher ridge here and there, almost entirely covered by water. As soon as this retreats, the heat of the sun in July and August causes the Grasses and Cyperaceæ to grow with extraordinary luxuriance and rapidity, so that in the beginning of September, when we first visited this part of the country, it was with difficulty that we could believe that it had so recently been inundated, the grass having by this time in many places attained a height of between 5 and 6 feet, and being so dense as to render walking through it exceedingly tiresome.

The autumn of 1858 and part of the summer of 1859 were spent in these localities, and the greater portion of the plants collected were obtained from within a few miles of the Boundary-line on either side.

The banks of the Lower Fraser River and (with the exception of the clear grounds above mentioned) the whole of this district are densely covered with forest, many of the trees in which attain a very large size.

The trees most commonly met with are the *Abies Douglasii*, Lindl. (the Douglas spruce or fir), several specimens of which, measured in the neighbourhood of Sumass, were found to be nearly 30 feet in circumference at five feet from the ground. Two hundred and fifty feet was the measured length of one that had been blown down; but some which we saw must have been considerably higher than this.

The *Abies Menziesii* (Menzies' spruce or fir), a large tree, 25 to 30 feet in circumference, and at least 200 feet high.

The *Abies Mertensiana* (hemlock spruce of our axmen) is a common tree, growing to the height of 150 or 200 feet. Some trees were observed with a perfectly straight trunk of 60 or 70 feet high before giving off a branch.

The *Pinus contorta* is not uncommon here.

The *Thuja gigantea*, Nutt., known as the 'Cedar,' also attains a very large size in this neighbourhood. The circumference of one measured was 26 feet 9 inches at six feet from the ground, and the estimated height 250 feet. This and the Douglas fir are the most useful trees on this part of the coast. There is a large and increasing export of the Douglas fir, both as spars and lumber, from Puget's Sound as well as from Vancouver Island.

Various parts of the 'Cedar' are applied to different purposes by the Indians. The trunk is used to form their canoes, and, when split into slabs (which it is very easily), to build their permanent huts or lodges. The stringy bark and the integuments of the root are plaited into useful and ornamental articles of clothing and household utensils.

At intervals, interspersed amongst the trees already mentioned, we find small clumps or solitary specimens of the *Acer macrophyllum*, Pursh (large-leaved maple). This tree chooses the more open parts of the forest, where it sometimes attains a height estimated at 150 feet. The circumference of one measured was 20 feet. Along with this tree, as well as in other places, we meet with the *Acer circinatum*, Pursh, *Cornus Nuttallii*, And. (which grows to the height of 60 to 80 feet in all, with a straight trunk of 14 or 15 feet before branching, and a diameter of about a foot and a half), the *Alnus viridis*, DC., the *Alnus rubra*, Big. (a common tree, most plentiful in wet places), and the *Betula occidentalis*, Hook. (a tree growing to the height of 60 or 70 feet, and most common about the borders of the forest). Along the immediate banks of the Lower Fraser, on islands and on low grounds subject to annual overflow, narrow belts of poplar (*Populus balsamifera*, L.) of large size frequently occur.

The undershrubs of this district consist chiefly of the following:—

Mahonia, two species.
Acer glabrum, *Torr.*
Spiræa, several species.
Rubus, several species.
Ribes, several species.
Panax horridus, *Pl. & Dcne.*
Lonicera involucrata, *Banks.*
—— occidentalis, *Banks.*
Viburnum Opulus, *L.*
Vaccinium, several species.
Gaultheria Shallon, *Pursh.*

But in the denser parts of the forest no undergrowth exists, the spaces between the trees being filled up by others which have either been blown down by storms or laid prostrate by the hand of time. These are found in various stages of decay, and overriding each other at all angles, rendering progress through such woods in anything like a straight course impossible even for a man on foot and without any burden, and in any direction difficult and laborious. In the more open spots and along the borders of the forests, in addition to the shrubs above mentioned, the following are a few of the most characteristic plants, viz.:—

Anemone nemorosa, *L.*, var.
Aquilegia formosa, *Fisch.*
Dielytra saccata, *Nutt.*
Dentaria tenella, *Pursh.*
Circæa Lutetiana, *L.*
Tellima grandiflora, *Doug.*
Mitella caulescens, *Nutt.*
Tiarella trifoliata, *L.*
Linnæa borealis, *Gronov.*
Chimaphila umbellata, *Pursh.*
Pyrola, three or four species.
Monotropa uniflora, *L.*
—— lanuginosa, *Nutt.*
Arctostaphylos Uva-ursi, *L.*
Castilleja parviflora, *Bong.*
Rhinanthus minor, *Ehrh.*

Calypso borealis, *Salisb.*
Corallorhiza multiflora, *Lindl.*
Platanthera fœtida, *Geyer.*
Cypripedium parviflorum, *Salisb.*
Lilium Canadense, *L.*
Smilacina, three species.
Streptopus amplexifolius, *DC.*
Trillium grandiflorum, *Salisb.*

Along the banks of the Sumass Lake and River and lower part of the Chilukweyuk River, and on the clear grounds or prairies of the same name, besides numerous representatives of the families Junceæ, Carices, Gramineæ, &c., the following plants commonly occur, viz.:—

Ranunculus, several species.
Nuphar advena, *Ait.*
Viola, two or three species.
Stellaria, two or three species.
Cerastium, two species.
Silene Douglasii, *Hook.*
Claytonia, several species.
Geranium Carolinianum, *L.*
Impatiens pallida, *Nutt.*
Rhamnus Purshianus, *DC.*
Cerasus emarginata, *Doug.*
—— demissa, *Nutt.*
Geum macrophyllum, *W.*?
Agrimonia Eupatorium, *L.*
Potentilla, two or three species.
Fragaria, two or three species.
Rubus, several species.
Cratægus sanguinea, *Pall.*
Pyrus rivularis, *Doug.*
Amelanchier Canadensis, *Torr. & Gr.*
Epilobium, several species.
Ribes, several species.
Philadelphus Lewisii, *Pursh.*
Sium lineare, *Mx.*
Cicuta virosa, *L.*
Œnanthe sarmentosa, *Nutt.*
Angelica arguta, *Nutt.*?
Symphoricarpus racemosus, *Mx.*
Sambucus pubens, *Mx.*
Viburnum Opulus, *L.*
Cornus Canadensis, *L.*
Galium, four species.
Plectritis congesta, *Nutt.*
Compositæ, various.
Apocynum, two species.
Menyanthes trifoliata, *L.*
Lithospermum pilosum, *Nutt.*
Mimulus moschatus, *Doug.*
—— luteus, *L.*
Castilleja, two species.
Prunella vulgaris, *L.*
Scutellaria, two species.
Stachys, two species.
Plantago major, *L.*
Polygonum, several species.
Populus tremuloides, *Mx.*
Corylus rostrata, *Ait.*
Salix, several species.
Alisma Plantago, *L.*
Sagittaria variabilis, *Engl.*
Sisyrinchium, two species.

In the *second* region, which extends on one side of the Columbia from the Dalles to the Spokan River, and on the other side runs up through the Okanagan valley and crosses the 49th parallel at Lake Osoyoos and the Similkameen, the vegetation is of a very different character from that met with on the other side of the Cascade Mountains, and bears indications of a much drier climate. A good many of the plants found in this region are strictly local in their distribution. Excepting by the banks of lakes or streams, there are no trees; and some of the orders, such as Ranunculaceæ, Caryophyllaceæ, Portulaceæ, Rosaceæ, Crassulaceæ, Saxifragaceæ, Vacciniaceæ, Orchidaceæ, Liliaceæ, &c., of which species are so plentiful in the first region, have here comparatively few representatives, whilst others, such as Leguminosæ, Onagraceæ, Polemoniaceæ, &c., are more common in this district and give a character to the vegetation; the genera of many other orders are about equally numerous in both.

The following is a list of plants observed only on the comparatively barren grounds of the Columbia valley and in the neighbourhood of the Dalles and Walla Walla, with their geographical distribution:—

Delphinium azureum, *Mx.* United States.
Pæonia Brownii, *Doug.* N.W. America only.
Vesicaria Ludoviciana, *DC.* Local.
Ceanothus integerrimus, *H. & A.* Local.
Glycyrrhiza glutinosa, *Nutt.*? Local.
Petalostemon macrostachyus, *Torr.*
Trifolium fimbriatum, *Lindl.* Local.
—— variegatum, *Nutt.*? Local.
Hosackia stolonifera, *Lindl.* Local.
—— decumbens, *Bth.* Local.
Astragalus succumbens, *Doug.* Local.
—— lentiginosus, *Doug.* Local.
—— Canadensis, *L.* E. and W. of Rocky Mountains.
Phaca podocarpa, *Hook.* Local.
Lupinus leucophyllus, *Doug.* Local.
Thermopsis fabacea, *DC.* Local, and Kamtschatka.
Œnothera albicaulis, *Nutt.* Oregon and Saskatchewan.
—— triloba, *Nutt.*? Red River and Arkansas.
—— parvula, *Nutt.* Local.
—— andina, *Nutt.* Local.
—— densiflora, *Lindl.* Local.
—— quadrivulnera, *Doug.* Local.
Silphium ? læve, *Hook.* Local.
Balsamorhiza hirsuta, *Nutt.* Local.
Helianthus petiolaris, *Nutt.* Only Missouri and Arkansas.
Layia glandulosa, *H. & A.* Local.
Antennaria dimorpha, *Nutt.* Local.
Stephanomeria minor, *Nutt.* Platte River.
Gilia Hookeri, *Bth.* Local.
Lithospermum ruderale, *Doug.* Local.
Amsinckia lycopsoides, *A. DC.* Local.
Eritrichium leucophæum, *A. DC.* Local.
Heliotropium Curassavicum, *L.* Generally distributed.
Pentstemon triphyllus, *Doug.* Local.

Pentstemon acuminatus, *Doug.* Local.
Orthocarpus hispidus, *Bth.* Local.
Anoplanthus fasciculatus, *Endl.* Saskatchewan.
Abronia mellifera, *Doug.* Platte River.
Eriogonum angustifolium, *Nutt.* Local.
—— vimineum, *Doug.* Local.
—— elatum, *Doug.* Platte and New Mexico.
—— compositum, *Doug.* Local.
Rumex venosus, *Pursh.* Missouri and Louisiana.
Euphorbia glyptosperma, *Engl.*? E. and W. of Rocky Mountains to New Mexico.
Hesperocordon hyacinthinum, *Lindl.* Local.

The *third* district comprehends the higher regions of the Cascade and Rocky Mountains, including the Galton Range, which lies near the latter, between the Tobacco Plains of the Kootenay and the Flathead River. The highest points at which we had an opportunity of collecting were on the Cascades at 7500 feet, and on the Rocky Mountains at about 8300 feet.

The following is a list of plants which were found to be almost if not entirely confined to those mountains, at a height of at least 4000 feet above the sea, with their geographical distribution :—

Anemone alpina, *L.* Arctic N. America. Cold N.E. and N.W. America and Europe.
—— parviflora, *Mx.* Arctic E. and W. America. Cold E. America.
Ranunculus Eschscholtzii, *Hook.* All Arctic Regions. N. Europe, N. Asia, N.E. and N.W. America, and Himalaya.
Caltha leptosepala, *DC.* Local. Cascade and Rocky Mountains, and northwards.
Trollius patulus, *Salisb.* Siberia.
Aquilegia Canadensis, var. fl. yellow. Local.
Turritis stricta, *Grah.* Columbia valley.
Draba alpina?, *L.* All Arctic Regions. Mountains of cold Europe, Asia, and America, and Himalaya.
—— lævipes, *Hook.* Rocky Mountains only.
Parnassia fimbriata, *Banks.* Rocky and Cascade Mountains, and northwards.
—— palustris, *L.* All Arctic Regions except Greenland. Cold Europe, Asia, America, and Himalaya.
Arenaria nardifolia, *Ledeb.*, var. glandulosa. Arctic E. and W. America. Siberia.
—— verna, *L.*, var. All Arctic Regions. Cold Europe, Asia, and America.
—— arctica, *Stev.*, var. All Arctic Regions. Cold Europe, Asia, and America.
Stellaria borealis, *Big.* Arctic Europe and E. and W. America. Cold Europe, Asia, America, and Himalaya.

Stellaria longipes, *Gold.* All Arctic Regions. Cold Asia and E. and W. America.

Silene acaulis, *L.* All Arctic Regions. Cold Europe and W. America, and tops of White Mountains in United States.

Lychnis apetala, *L.* All Arctic Regions. All cold Asia and America. Himalaya. Antarctic America.

Talinum pygmæum, *A. Gr.* Rocky and Cascade Mountains only.

——, n. sp.? Cascade Mountains only.

Spraguea umbellata, *Torr.* Cascades and California only.

Spiræa pectinata, *Torr. & Gr.* Arctic W. America.

—— corymbosa, *Raf.*, var. β. Cold E. and W. America and Kamtschatka.

Dryas octopetala, *L.* All Arctic Regions. Cold Europe, Asia, and America.

Geum strictum, *Ait.* Arctic Europe and Arctic E. America. Cold Europe, Asia, and America. Cold S. America. Himalaya. Australia.

Sibbaldia procumbens, *L.* Arctic Europe and Greenland. Cold Europe, Asia, and America, and Himalaya.

Potentilla diversifolia, *Lehm.* Rocky and Cascade Mountains, and northwards.

—— nivea, *L.*, var. γ. Arctic and cold Europe, Asia, and America, and Himalaya.

Epilobium alpinum, *L.* Arctic and cold Europe, Asia, and America, and Himalaya.

Sedum Rhodiola, *DC.* All Arctic and cold Europe, Asia, and America, and Himalaya.

—— stenopetalum, *Pursh.* Rocky Mountains and Platte.

Saxifraga bronchialis, *L.* Arctic Europe, Asia, and W. America. Cold Asia and Rocky Mountains.

—— cernua, *L.* Cold and Arctic E. and W. America, and Himalaya.

—— ranunculifolia, *Hook.* Cascade and Rocky Mountains, and hills near the Kettle Falls of the Columbia.

—— hyperborea, *Br.* Arctic and cold Europe, Asia, and America.

—— Virginiensis, *Mx.* Arctic E. America. Cold E. and W. America.

—— heterantha, *Hook.* Cascade and Rocky Mountains, and northwards.

—— Dahurica, *Willd.* Arctic W. America. Cold Asia. Rocky Mountains.

Mitella pentandra, *Hook.* Cascade and Rocky Mountains and California.

—— nuda, *L.* Arctic E. America. Cold Asia and E. and W. America.

Cymopterus, n. sp. Cascade Mountains only.

Valeriana capitata, *Willd.* All Arctic and cold Europe, Asia, and America, except Greenland.

Nardosmia palmata, *Hook.* Arctic and cold E. and W. America and N.E. Asia.

Aster salsuginosus, *Rich.* Arctic and cold E. and W. America.

—— Engelmanni, *A. Gray.* Rocky and Cascade Mountains.

Actinella acaulis, *Nutt.* East side of Rocky Mountains and Platte.

Senecio canus, *Hook.* N.E. and N.W. America.

——, n. sp.? near frigidus. Rocky Mountains only.

Arnica angustifolia, var. Arctic Europe and E. and W. America. Cold Europe, Asia, and America.

—— mollis, *Hook.* Rocky and Cascade Mountains.

—— Chamissonis, *Less.* Rocky and Cascade Mountains, and northwards. White Mountains of N. America.

Macrorhynchus elatus, *Nutt.?* Oregon and Cascade Mountains only.

Youngia pygmæa, *Ledeb.* Rocky Mountains. Arctic E. and W. America. Siberia.

Moneses grandiflora, *Salisb.* N.E. and N.W. America. Europe and Siberia.

Cladothamnus pyroliflorus, *Bong.* From the mouth of the Fraser River northward to Sitcha.

Menziesia Grahami, *Hook.* Rocky and Cascade Mountains.

—— glanduliflora, *Hook.* Rocky and Cascade Mountains, and northwards.

—— empetrifolia, *Sm.* Cascade and Rocky Mountains.

Andromeda (Cassiope) cupressina, *Hook.* Cascades to Sitcha.

—— tetragona, *L.* Arctic Europe, Asia, and America. Cold Asia and America.

Kalmia glauca, *Ait.* Arctic and cold E. and W. America.

Rhododendron macrophyllum, *Don.* Cascade Mountains and California.

—— albiflorum, *Hook.* Cascade and Rocky Mountains.

Ledum glandulosum, *Nutt.* Cascade and Rocky Mountains and California.

Gentiana Parryi, *Engl.* Cascade and Rocky Mountains, and southwards.

—— propinqua, *Rich.* Arctic and cold E. and W. America.

Polemonium pulcherrimum, *Hook.* Rocky Mountains. Arctic Europe. E. and W. America.

—— confertum, *A. Gr.* Rocky Mountains and southwards.

Myosotis sylvatica, *Hoff.* Arctic Europe, Asia, and America, but not Greenland. Cold Europe, Asia, and America, and Himalaya.

Eutoca sericea, *Hook.* Rocky Mountains only.

——, n. sp.? near Franklinii. Rocky Mountains.

Romanzovia Sitchensis, *Bong.* California. Unalaschka.

Pentstemon Menziesii, *Hook.* Vancouver Island, Cascade Mountains, and California.

—— confertus, *Doug.* Rocky Mountains and California.

Veronica alpina, *L.* Arctic Europe, Asia, and Greenland. Cold Europe, Asia, and America.

Pedicularis surrecta, *Bth.* California, Cascade and Rocky Mountains, and Hudson's Bay.

—— racemosa, *Doug.* Cascade and Rocky Mountains to California.

—— bracteosa, *Bth.* Cascade and Rocky Mountains. Saskatchewan south to Colorado.

Pinguicula vulgaris, *L.* Arctic Europe and E. America. Cold Europe and America.

Androsace septentrionalis, *L.* Arctic and cold Europe and Asia (Greenland excepted).

Dodecatheon dentatum, *Hook.*? Cascades only.

Eriogonum umbellatum, *Torr.* Cascade and Rocky Mountains south to Colorado River.

Oxyria reniformis, *Hook.* All Arctic and all cold Europe, Asia, and America, and the Himalaya.

Polygonum viviparum, *L.* All Arctic and all cold Europe, Asia, and America, and the Himalaya.

Betula glandulosa, *Mx.* Arctic and cold E. and W. America.

Salix cordata, *Mhlbrg.* Arctic and cold E. America. Cascade and Rocky Mountains.

—— glauca, *L.* All Arctic and cold Europe, Asia, and America.

—— arctica, *Pall.* Arctic and cold E. and W. America. Cold Asia.

—— phlegophylla, *And.* Arctic E. and W. America. Cold W. America.

—— reticulata, *L.*, vars. nana and vestita. Arctic and cold E. and W. America.

Pinus flexilis, *Torr.* Cascade and Rocky Mountains. Colorado.

Larix Lyallii, *Parl.*, n. sp. Cascade and Rocky Mountains.

Peristylus bracteatus, *Lindl.* Arctic Europe. Cold Europe, Asia, and N.E. America.

Xerophyllum tenax, *Nutt.* Rocky and Cascade Mountains.

Stenanthium, n. sp. Cascade Mountains. Kootenay River.

Juncus xiphioides, *Mey.* California. Cascades and Rocky Mountains.

Carex Mertensii, *Prescott.* Cascade Mountains.

—— canescens, *L.* Arctic Europe and E. America. Cold Europe, Asia, and America. Extratropical S. America. Australia.

—— comosa, *Boott.* Cascade Mountains. U.S. America.

—— verticillata, *Boott.* N.W. America.

—— tenella, *Schk.* Cold N.E. and N.W. America.

—— Nardina, *Fries.* Arctic Europe and E. America. Cold Europe and E. America.

—— Rossii, *Boott.* Cascade Mountains and Rocky Mountains. New Mexico.

—— scirpoidea, *Mx.* Arctic and cold E. America and cold Europe.

—— rigida, *Good.* Arctic Europe, Asia, and N.E. America. Cold Europe and E. America.

—— Lyallii, *Boott*, n. sp. Cascade Mountains.

—— cæspitosa, *L.* (*Boott!*) Arctic Europe. E. and W. America. Cold Europe, Asia, and America.

—— atrata, *L.*, var. Arctic Europe. E. and W. America. Cold Europe and Asia. Top of White Mountains in America. Himalaya.

—— nigricans, *Mey.* Rocky Mountains.

Scirpus cæspitosus, *L.* Arctic Europe. E. and W. America. Cold Europe, Asia, and America.

Alopecurus alpinus, *L.* Arctic and cold Europe, Asia, and America, and cold S. America.

Cinna pendula, *Trin.* Cascade Mountains. Amoor River; Siberia; Norway; Middle Russia; Sitcha.

Trisetum subspicatum, *Beauv.* Arctic Europe and E. and W. America. Cold Europe, Asia, and America. Andes; Himalaya; Australia.

Poa alpina, *L.* Arctic Europe and E. and W. America. Cold Europe, Asia, and America, and Himalaya.

Polypodium alpestre, *Hoff.*

The plants gathered by us at the eastern base of the Rocky Mountains which we did not also obtain from other localities are so few in number, that it appears hardly necessary to notice them in this report. They are the following, viz.:—

Geranium albiflorum, *Hook.*
(Hookerianum, *Walp.*)
Astragalus pauciflorus, *Hook.*
Oxytropis splendens, *Doug.*
Hedysarum boreale, *Nutt.*
Actinella acaulis, *Nutt.*
Alopecurus alpinus, *L.*

Of these, the only one which has not also a locality assigned to it to the westward of the Rocky Mountains is *Oxytropis splendens.*

### *Notes on the Distribution of the principal Trees met with near the 49th degree of Latitude, and the Elevation to which they reached, between the Gulf of Georgia and the Rocky Mountains.*

*Pinus monticola*, Doug., was found in Vancouver Island, as well as in the Lower Fraser River district, and is a common tree in the wooded valleys lying between Colville and the Rocky Mountains.

*Pinus contorta*, Doug., is very common in various situations in Vancouver Island as well as on the mainland. On the east side of the Cascade Mountains it forms the great bulk of the forest between the altitudes of 4500 and 6500 feet above the sea, where the size of large trees is about 1½ foot in diameter and 60 or 70 feet high. On the Rocky Mountains it was observed at 7000 feet above the sea. Along both sides of the trail in the passes of the Galton and Rocky Mountains, many of the young trees of this species are stripped of their bark from a foot or so above the ground to a height of six or seven feet. This is done by the Indians, during their annual hunting-excursions from the Kootenay and Kalispelm country to the Buffalo Plains on the east side of the Rocky Mountains, for the sake of the inner bark, which they use as food, as well in its fresh state as when compressed into thick cakes so as to render it portable. Near the south-east end of Vancouver

Island this tree is common in rocky situations and on promontories exposed to the gales of the Straits of Fuca, where it varies considerably in size, being for the most part stunted, but in some places attaining a height of 50 or 60 feet.

*Pinus flexilis*, Torr., was first observed by us near the eastern summit of the Cascade Mountains, about 7000 feet above the sea, where it was found as the highest tree of the forest belt, growing amongst rocks and granite débris, exposed to the full force of the storms which so frequently sweep over this elevated region. Here it was quite stunted and shrubby in its habit. The trunk of the largest seen in this situation was about 15 feet high, bulging out a little for a foot or so above the ground, then tapering pretty rapidly, and spreading out at the top into a number of thickish branches. No cones of this tree could be found on the Cascades; in the following year, however, they were procured both on the Galton and Rocky Mountains in great plenty, but unfortunately all too young for the seed to be of any use. The seed, which is about the size of a pea, is sweet and palatable, and is eaten by the Indians. This tree was found growing on the Rocky Mountains at an elevation of 8000 feet.

*Pinus ponderosa*, Doug. Immediately on penetrating to the eastward of the Cascade Mountains this fine tree was met with, but was not seen on the Pacific side of that range. It extends from the eastern slope of the Cascades, where individual specimens were seen as high as 3600 feet, to the base of the Rocky Mountains. Its most common associate along this line of country is the *Larix occidentalis*. Wherever these are found growing together, the ground is usually more or less level (flat land, or hills of no great steepness), covered with grass, and so open as to render progression easy, without confining the traveller constantly to the cleared and beaten trail, as is always the case in the forests west of the Cascade Mountains.

In the district spoken of, narrow valleys and ravines, as well as the steep sides of hills with northern exposures, are mostly inhabited by species of *Abies*, with which the *Pinus ponderosa* and Larch do not care to mingle; and in these situations no grass is to be found, although the prairie-ground extends to the very margin of the bank or ravine.

About Colville the *Pinus ponderosa* rivals in usefulness the Douglas fir on the coast, and is applied to most of the same purposes. This was the tree used on several occasions to form canoes to enable our parties to cross the deeper rivers, and it answered the purpose very well, being easily dug out, but it floated rather deep in the water.

*Abies Mertensiana*, Lindl. (Hemlock spruce of our axmen), one of the most common trees on the west side of the Cascades, is also met with on the east side, but is not so common, nor does it attain the same height as near the coast.

*Abies Menziesii*, Lamb., is common all along the line from the Pacific to the Rocky Mountains. It is one of the common trees already mentioned as existing in the ravines between the latter and the Cascades. On the Cascade Mountains it was observed at a height of about 5500 feet above the sea, and on the Galton and Rocky Mountains it was found as high as 6000 feet.

*Abies Douglasii*, Lindl., is usually found along with the preceding. This tree, which is such a giant in the Lower Fraser River district, becomes stunted and dwarfish on exposed promontories and at great elevations. It ceases to be common at an altitude of about 5500 feet above the sea, but scrubby specimens were seen on the Cascades nearly 2000 feet higher than that. It never attains the same proportions east of the Cascade Mountains that it does on the other side.

*Abies amabilis*, Doug., is not uncommon on the Cascade Mountains up to 6000 feet, and on the Rocky and Galton Mountains was found at an elevation of 7000 feet.

*Abies grandis*, Doug.?, was seen on the Cascade Mountains, and on their spurs running down to the Columbia River.

*Picea nobilis*?, Don (*balsamea*?), was found on the Cascade Mountains, near Lake Chilukweyuk. It is a large and handsome tree, with a soft wood easily cut by the axe. The bark, especially of the young, is smooth and shining, and covered with blisters containing a turpentine or balsam-like fluid.

*Larix Lyallii*, Parl. (n. sp.). First seen on the Cascade Mountains, where, at from about 6500 to 7000 feet, it formed in one place an open belt of trees, towards the upper part mingled with and afterwards overtopped by the *Pinus flexilis*. On the Galton Range it was found under the same circumstances at an altitude of about 6000 feet, and on the Rocky Mountains at 7000 feet. In the latter situation it was associated with the *Pinus flexilis* and the *Abies amabilis*.

*Larix occidentalis*, Newb. (an Nutt.?), occurs frequently between the Cascade and Rocky Mountains, associated with the *Pinus ponderosa*; and as the *Pinus ponderosa* here supplants for many purposes the Douglas fir, so the larch, from its splitting so easily, is applied to many of the uses fulfilled by the *Thuja gigantea* ('Cedar') on the other side of the Cascades, such as making shingles, rails for fences, &c.

*Thuja gigantea*, Nutt., which, as already mentioned, is common and grows to a very large size near the sea-coast, is comparatively scarce in the interior, where it is only met with in damp, shady ravines, or near moist river-banks such as those of the Pend Oreille; but even there it seldom attains a size at all to be compared with that which it reaches on the western side of the Cascades.

*Juniperus Virginiana*, L., occurs occasionally in the form of a tree in Vancouver Island, as well as along the boundary up to the Rocky Mountains. The measurements of one at Esquimalt were —circumference at six feet above the ground, 5 feet 4 inches; length of same tree (which had been blown down) 46 feet. Lowest branch five feet from the ground.

*Acer macrophyllum*, Pursh, one of the ornamental trees of the western forests, was not observed to the eastward of the Cascade Range.

*Quercus Garryana*, Doug. (the only Oak seen), which is plentiful at the S.E. end of Vancouver Island, was not found on the mainland anywhere along the 49th parallel. It was seen in the neighbourhood of the Dalles, but did not extend much higher on the Columbia.

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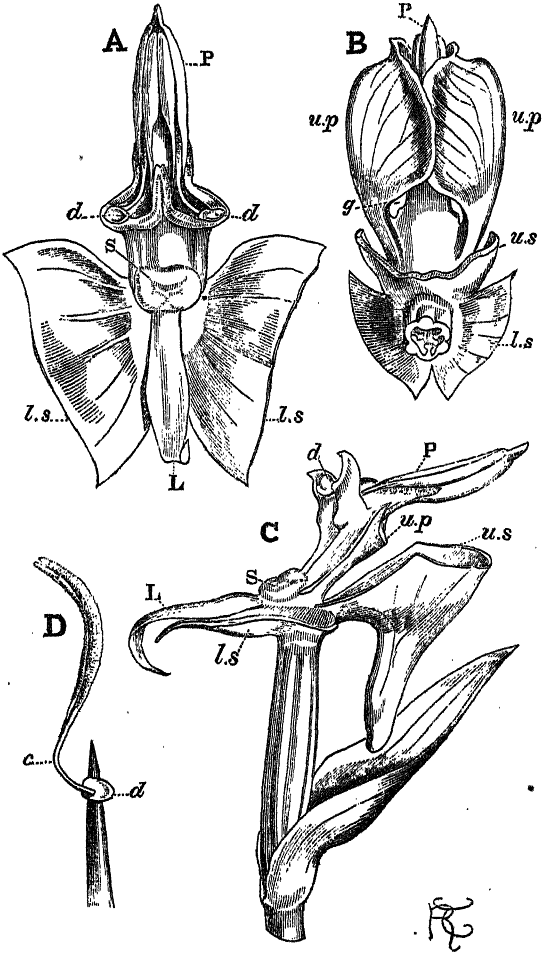
## On the Fertilization of *Disa grandiflora*, Linn. By ROLAND TRIMEN, Esq., of the Colonial Office, Cape Town: drawn up from Notes and Drawings sent to C. DARWIN, Esq., F.L.S., &c.

[Read June 4, 1863.]

As none of the many various South African Orchids have been described in relation to their manner of fertilization, I have thought that a brief account of the structure of the *Disa grandiflora* might be acceptable.

In the great majority of Orchids the labellum, or lower lip, secretes nectar, and stands in front of the column which bears the stigma and pollen-masses. In the *Disa* the labellum is greatly reduced in size; the posterior sepal, on the other hand, is largely developed, and forms a spur which contains nectar. As the nectary thus stands at the back of the column (see fig. C) behind the stigma and pollen-masses, in a directly opposite position to that which it occupies in other Orchids, it may naturally be asked,



A. Column viewed in front, showing the labellum, with the two lower sepals partly cut off; the two upper petals and upper sepal wholly removed.

B. Back view of column, showing the two upper petals: the upper sepal is cut off so close that the nectary is not shown.

C. Side view of the column and ovarium, with the labellum viewed edgeways; with the upper petals and upper sepal partly cut away, with the spur or nectary left.

D. Pollinium, attached to a needle, viewed laterally.

P. pollinium.
*d.* disc of pollinium.
*c.* caudicle of pollinium.
S. stigma.

L. Labellum.
*u. p.* upper petals.
*u. s.* upper sepal with nectary.
*l. s.* lower sepals.
*g.* gateway or passage leading to the nectary, between the upper petals and the column.

How can insects effect the fertilization of the flower? This is effected with marvellous simplicity by a very slight change in the form of the two upper petals, and in the position of the viscid discs of the pollen-masses.

The upper sepal is of large size, with the basal margins folded inwards, and these, together with the two upper petals which overlap each other behind, enclose the column, so that insects, to reach the nectar, are compelled to approach the flower in front, in precisely the same manner as if the labellum secreted nectar. But as the column stands in the way of the nectary, insects must push their probosces or heads on either side of it, in order to reach the nectar. The flower is manifestly constructed to favour this action; for the two upper petals have narrow bases, which leave a small open gateway on each side of the column, as may be seen in the drawing (B) of these two petals and of the back of the column. In all common Orchids the two viscid discs, to which the pollen-masses are attached, stand close together or are some way removed from each other; but they always face either the base or the sides of the labellum. In the *Disa* the two discs are widely removed from each other, and face outwards from the labellum towards the margins of the column, as may be seen in the front view (A) of the flower.

It is impossible to doubt the meaning of this unusual position of the discs; for they are thus seated on the inner margins of the two gateways or passages which lead to the nectary. If a needle be inserted through one of these passages, it inevitably touches the extremely viscid disc of that side; and when the needle is withdrawn, the pollinium is withdrawn. In figs. A and C the position of the medial stigma, seated some way beneath the discs, may be seen; and in fig. D the shape of the elongated pollinium, attached to a needle, is shown, with the caudicle bent almost at right angles near to the disc. In most British Orchids, when the pollinia are removed from their cases, the caudicles undergo a movement of depression, caused, as described by Mr. Darwin, by the contraction of the discs; and at the same time they bend either outwards or inwards, always in strict relation to the position of the stigma. In the *Disa* there is no movement of this nature, but the end of the much-elongated pollinium bends downwards, from its weight, and is brought towards the centre of the flower by the crookedness of the caudicle; so that when a needle, with a pollinium attached to it, is inserted into the passage leading to the nectary, the end of the pollen-mass strikes the stigma and leaves pollen-grains on its sticky surface. Thus in the *Disa*, notwithstanding the remarkable difference in the position of the nectary, every part of the flower, by the aid of very slight modifications, has become neatly coordinated to ensure fertilization through the agency of insects.

The *Disa* carpets with its narrow lanceolate leaves the margins of the almost dry watercourses on the southern spur of the Table Mountain. In February its superb flowers expand. When I examined the plants, most of the flowers were partially withered; but in the greater number, even in those quite withered, both pollinia were still in their cases; in not one instance had both been removed; but in several flowers one had been carried away. In some of the withered flowers the pollinia protruded from the anther-case; and in a few instances the upper sepal, in curling inwards, had touched the disc and had drawn out the pollinium: but I saw no case in which the pollen-grains had thus reached the stigma. Considering how well stored the nectary is with honey, it is surprising that the flowers are not more regularly visited; but as the nectar fills the lower part alone of the nectary, only insects with a long proboscis could reach it; and perhaps the larger moths are rare at the elevation at which this plant grows. The remarkably brilliant colours, however, of the flower probably indicate that it is attractive to some day-flying Hymenopterous or Lepidopterous insect. However this may be, the infrequency with which the pollen-masses are removed offers a nearly parallel case to that described by Mr. Darwin, of the extremely imperfect fertilization of the *Ophrys muscifera* in England.

# On the *Musci* and *Hepaticæ* from the Cameroons Mountain and from the River Niger. By WILLIAM MITTEN, A.L.S.

[Read June 18, 1863.]

THE species here enumerated appear to represent a Moss vegetation similar to that of tropical America; in a few instances they are apparently identical, but for the most part they are rather cognate forms; with those found at the Cape they appear to have but a small affinity. On the higher parts of the Cameroons Mountain the species are absolutely identical with those from the mountains of Abyssinia, intermixed with a few hitherto only known from the Island of Bourbon.

## DICRANACEÆ, *Mitten.*

### LEPTOTRICHUM, *Hampe.*

### (*Distichium*, Bryol. Europ.)

L. CAPILLACEUM, *Hedw.*
*Hab.* Cameroons Mountain, alt. 7000 feet.

### LEUCOLOMA, *Brid.*

L. SECUNDIFOLIUM, sp. nov. Dioicum, cæspitosum, caule ramoso, foliis falcatis secundis e basi latiore sensim longe angustatis apice angustissimis marginibus apice minute serrulatis nervo angusto pallido excurrente, cellulis in folii medio oblongis superioribus obscuriusculis ad margines angustis elongatis hyalinis medium versus folii longitudinis limbum latiusculum formantibus longe infra apicem evanescentibus, alaribus pluribus quadratis fuscis, perichætialibus e basi oblonga convoluta subulatis, theca in pedunculo semiunciali rubro ovali cylindracea, peristomio dentibus brevibus ut plurimum trifidis.
*Hab.* Island of St. Thomas, lat. 0, *Mann.*

Pale glaucous green; stems two to three inches high, curved; leaves secund, at the apices of the stems falcate. A more robust species than *L. macrodon*, Hook.

### DICRANUM, *Hedw.*

### (*Pedunculus erectus.*)

D. OBLIQUATUM, sp. nov. Dioicum, cæspitosum, caule humili ramoso, foliis subsecundis e basi latiore sensim longe angustatis, nervo latitudinis folii partem tertiam occupante fere ad apicem a pagina distincto, apice dorso marginibusque serrulatis, cellulis alaribus a reliquis non discretis, basi oblongis rectangularibus, ad nervum majoribus et spatium fere quartum folii basis occupante, inde oblongis, ad apicem rotundatis, perichætialibus e basi latiore oblongo-ovata convoluta subulato-attenuatis, theca in pedunculo elongato gracillimo luteo-viridi recto inclinata cylindracea inæquali viridi siccitate plicata, operculo subulato longe rostrato rubro, peristomio dentibus elongatis dicranis.
*Hab.* Peak Clarence, Fernando Po, on trees, *Mann.*

The foliage of this species resembles that of *D. fulvum*, Hook.; but the capsule is more like that of *D. Scottianum*, Turn., which is a much larger species. *D. flagellare*, Hedw., has leaves wider upwards, with a different structure at the base; in *D. obliquatum* the place of the alar cells is evident, but the brown enlarged cells appear to be dispersed through the base of the leaf in an irregular manner. The inclined capsule of this moss gives it a different appearance from any of its near allies.

### (*Pedunculus flexuosus.*)

D. STRAMINEUM, sp. nov. Dense cæspitosum, caule elongato inferne

fusco tomentoso parce ramoso, foliis erecto-patentibus e basi latiore sensim longe angustatis, marginibus integerrimis incurvis, nervo basi ⅗ superne totam folii latitudinis occupante, cellulis alaribus pallide fuscis, inde ad latera angustis hyalinis, interioribus latioribus sensim superne in minutas oblongas rotundatasque transeuntibus, perichætialibus externis e basi ovata latiore internis e basi oblonga convoluta subulatis, theca in pedunculo cygneo flexu ovali æquali plicata, operculo subulato rostrato, peristomio dentibus rubris dicranis, annulo composito, calyptra basi fimbriata.

*Hab.* Cameroons Mountain, alt. 9000 feet, *Mann.*

Closely allied to *D. nivale*, Brid., but seems to differ in the less rigid foliage and more evident lamina of the leaf at the base. The stems are from two to three inches in height, and the foliage yellowish green and straw-coloured.

D. DIVARICATUM, sp. nov. Laxe cæspitosum, caule erecto ramoso radicellis rubris tomentoso, foliis divaricatis lanceolato-subulatis apice serrulatis, nervo lato tertiam partem folii latititudinis occupante fere ad apicem a pagina discreto percurrente, cellulis alaribus numerosis a reliquis distinctis fuscis, basi ad nervum paucis oblongis ad margines brevibus quadratis, inde ad apicem parvis rotundatis.

*Hab.* Prince's Island, *Barter.*

Remarkable for its divaricate leaves, which when dry are incurved; it approaches *D. arenicolum*, C. Müller.

D. NIVALE, *Brid.*

*Hab.* Cameroons Mountain, alt. 9000–10,000 feet, on rocks, *Mann.*

D. ERICETORUM, *Mitten.*

*Hab.* Cameroons Mountain, alt. 7000–10,000 feet, on rocks, *Mann.*

These specimens are fertile; in the barren state the species is found in the warmer parts of Europe and the Atlantic Islands, but always without fruit.

### DIDYMODON, *Hook.*

D. RADICOSUS, sp. nov. Caule elongato, foliis e basi erectiuscula latiore recurvis squarrosis subsecundis lanceolatis nervo excurrente carinatis complicatisque, marginibus ad medium reflexis inde ad apicem serratis, cellulis basi elongatis pellucidis ad angulos brevibus quadratis superioribus rotundatis omnibus distinctis vix papillosis, perichætialibus exsertis longe convolutis, theca in pedunculo luteo flexuoso cylindracea pallida ore rubro, operculo subulato longirostro, peristomio dentibus angustis brevibus.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

Larger than its near allies, *D. squarrosus*, Hook., *D. sulphureus* and *D. aggregatus*, C. Müller. Leaves scarcely papillose, and cells everywhere with distinct pellucid interstices. Several rows of cells break up at the mouth of the capsule to form the annulus.

D. PUNGENS, sp. nov. Caule elongato ramoso, foliis e basi lata erecta sensim angustatis lanceolatis recurvis subsecundis complicatis, nervo in apicem tenuem excurrente, marginibus inferne reflexis apicem versus serratis, cellulis basi elongatis angustis sublævibus pallidis ad margines superioribusque omnibus minutis rotundatis subobscuris minutissime papillosis, perichætialibus interioribus erectis convolutis pellucidioribus, theca in pedunculo breviusculo gracili pallido ovali-oblonga erecta, operculo conico-acuminato, peristomio dentibus brevibus gracilibus.

*Hab.* Cameroons Mountain, alt. 10,000 feet, on rocks, *Mann.*

More slender than *D. radicosus*, and destitute of the rootlets amongst the leaves. The foliage, when dry, is nearly erect and appressed. The leaves are attenuated into a slender sharp point, and, excepting in two oblong spaces on each side of the nerve in the erect base occupied by the narrow elongated cells, they are everywhere nearly obscure.

D. FLEXIFOLIUS, *Hook. et Tayl.*

*Hab.* Cameroons Mountain, alt. 8000 feet, and on rocks inside the largest crater, Peak Clarence, Fernando Po, *Mann.*

D. PURPUREUS, *Hedw.*

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

D. CYATHICARPUS, (Zygodon) *Mont.*

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

This species was gathered in Abyssinia by Schimper.

## LEUCOBRYACEÆ, *C. Müller.*

### LEUCOPHANES, *Brid.*

L. UNGUICULATUS, sp. nov. Late cæspitosus, caule humili ramoso, foliis densis patentibus subsecundisve e basi concava latiore lanceolatis complicatis apice obtusis, nervo in apiculum brevissimum recurvum excurrente dorso lævi, margine tenui integerrimo, cellulis omnibus oblongis pellucidis.

*Hab.* Prince's Island, at the base of Oil Palms, *Barter.*

A little more robust than *L. glaucus* or *L. octoblepharoides*, from the more densely inserted leaves. The recurved point of the nerve, forming a small hook, is peculiar.

## TRICHOSTOMACEÆ, *Mitten.*

### ANŒCTANGIUM, *Hedw.*

A. SPATHULATUM, sp. nov. Cæspitosum, caule subsimplici radiculoso, foliis superioribus patentibus, apicalibus paululum recurvis elliptico-lanceolatis spathulatis, basi angustioribus nervo percurrente carinatis apice acutis integerrimis, cellulis parvis subobscuris basi ad nervum paucis oblongis pellucidioribus angulis decurrentibus, perichætialibus

late ovatis acutis, theca in pedunculo elongato gracili pallido elongato-ovali cylindracea, operculo longe subulirostrato.

*Hab.* Cameroons Mountain, alt. 8000 feet, on the ground, *Mann.*

In size and habit like the larger states of *A. æstivum*, Hedw., but with its upper leaves narrowed at the base, and a rather more dense areolation.

### TORTULA, *Hedw.*

T. CYLINDRICA, (Weissia) *Bruch.*

*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

### SYRRHOPODON, *Hook. et Grev.*

S. ARMATUS, sp. nov. Dioicus, late cæspitosus, caule brevi ramoso radicellis purpureis tomentoso, foliis e basi erecta paululo latiore utrinque dentibus setiformibus 3–6 ciliata lineari-lanceolatis patentibus concavis apice acutatis integerrimis, nervo angusto dorso aspero in mucronem excurrente, cellulis calymperoideis spatium subellipticum folii basis totum occupantibus, inde ad apicem minute rotundatis obscuris, dorso papillosis, theca in pedunculo gracili bilineari ovali, operculo subulato subæquilongo, peristomio dentibus brevibus.

*Hab.* Bagroo River and banks of the Nunn, on dead bark, *Mann.*

Very near to *S. spiculosus*, Hook. et Grev., and *S. trachyphyllus*, Mont., but with leaves more narrow at the base (scarcely wider than the upper portion), the nerve evidently excurrent, the marginal cilia at the base longer.

S. LAMPROCARPUS, sp. nov. Caule elongato parce ramoso, foliis e basi erecta oblonga vaginante patentibus anguste subulato-lanceolatis, nervo pallido dorso lævi percurrente, margine in parte vaginante lato pallido, inde ad apicem angustiore serrulato, cellulis calymperoideis totum partis vaginantis occupantibus inde ad apicem minutissimis obscuris, perichætialibus conformibus apicibus ad basin thecæ cylindraceæ vermicularis attingentibus, pedunculo rubro, operculo longe subulato, peristomio dentibus rubris angustis, calyptra fere basin thecæ tegente.

*Hab.* Fernando Po, *Mann.*

Stems one inch and a half high, slender, apparently not growing in a tufted manner. Leaves very pale green, rather remotely inserted, unaltered in position when wet or dry; including the base, they are about three lines long. Whole plant a little more robust than *S. tristichus*, Nees ab E., with which it nearly agrees in general appearance.

### CALYMPERES, *Swartz.*

C. AFZELII, *Swartz.*

*Hab.* Banks of the Nunn, and Prince's Island, *Mann.*

## GRIMMIACEÆ, *Mitten.*

### GRIMMIA, *Ehrh.*

G. ABYSSINICA, *B. et S.*

*Hab.* Cameroons Mountain, alt. 12,000 feet, with *Bryum pallescens*, Schw., *Mann.*

The inflorescence in these specimens, as well as in those from Abyssinia, is monœcious, and not diœcious, as described by Müller, Synops. p. 772.

## ORTHOTRICHACEÆ, *Mitten.*

### ZYGODON, *Hook. et Tayl.*

Z. SEMITORTUS, sp. nov. Dioicus, caule subunciali dichotome ramoso, foliis e basi brevi erectiuscula divergentibus semitortis elliptico-lanceolatis basi angustatis angulis decurrentibus integerrimis nervo sub apice latiusculo acuto evanescente carinatis, cellulis rotundatis distinctis sublævibus basi vix ullis diversiformibus, perichætialibus conformibus, theca in pedunculo 3–4-lineari ovali plicata, collo pyriformi, operculo subulato obliquo, peristomio ciliis 8 brevibus.

*Hab.* Cameroons Mountains, alt. 8000 feet, *Mann.*

A large species, resembling *Z. Reinwardti*, Schw., but with entire leaves.

### MACROMITRIUM, *Brid.*

M. LEVATUM, sp. nov. Cæspitosum, ramis erectis ramosis, foliis patenti-recurvis siccitate tortis late lanceolatis, apice in mucronem acuminatis nervo percurrente carinatis, marginibus uno latere inferne reflexis superne minute crenulatis, cellulis basi elongatis angustis, nonnullis paulo supra basin grosse papillosis, medium versus in parvas rotundatas diametro circiter $\frac{1}{3000}$ uncii metientes læves transeuntibus, perichætialibus paulo latioribus erectis, theca in pedunculo elongato globoso-ovata collo sensim attenuato plicata, operculo conico subulato, calyptra nuda thecam totam tegente, peristomio simplici.

*Hab.* Cameroons Mountain, alt. 8000–10,000 feet, on trees and rocks, *Mann.*

Allied to *M. sulcatum*, Hook., and, like it and its near allies, with a small triangular mass of calymperoid cells on one side of the nerve at the base of the leaf. The capsule is slightly and irregularly plicate when old; before the fall of the operculum it is smooth.

M. MENZIESII, sp. nov. *M. levato* simillimo, foliis late lanceolatis nervo excurrente carinatis, cellulis basi elongatis angustis papillosis superioribus rotundatis obscuris diametro circiter $\frac{1}{5000}$ uncii metientibus, theca in pedunculo elongato lævi basi-plicata late ovata, operculo conico subulato, peristomio simplici, calyptra nuda.

*Hab.* Sierra Leone, *Menzies in Herb. Hooker.* Fernando Po and Island of St. Thomas.

Very nearly resembling the preceding species and *M. sulcatum*; but the mature capsule is smooth and plicate only in the neck, and its leaves are of a more dense structure.

## FUNARIACEÆ, *Mitten.*

### ENTOSTHODON, *Schwægr.*

E. CURVIPES, *C. Müller.*
*Hab.* Cameroons Mountain, alt. 7000–8000 feet. Agrees exactly with the Abyssinian specimens.

### FUNARIA, *Schreb.*

F. HYGROMETRICA, *Dill.* (F. calvescens, *Schw.*)
*Hab.* Cameroons Mountain, alt. 7000 feet.

## BARTRAMIACEÆ, *Mitten.*

### BARTRAMIA, *Hedw.*

B. STRICTA, *Brid.*
*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

B. COMMUTATA, *Mitten.* (B. patens, *Schwægr.* t. 62.)
*Hab.* Cameroons Mountain, alt. 12,000 feet, *Mann.*
Much confusion appears to surround this species. Schwägrichen figured it supposing it to be identical with Bridel's *B. patens,* from Magellan ; and Bridel then refers to Shwägrichen's figure as representing his species. C. Müller (Synops. i. p. 497) refers it to *B. vulcanica,* Brid., an allied but distinct species with a short seta. Judging from the single perfect capsule on the present specimen, the species differs from *B. patens,* Brid., from Magellan, in the absence of an internal peristome; its leaves are also narrower and more nearly like those of *B. papillata,* Hook. f. et Wils., but they are not serrulate quite down to the shoulders of the vaginant portion, although the papillation is nearly similar.

B. HALLERIANA, *Hedw.*
*Hab.* Cameroons Mountain, alt. 9000 feet, *Mann.*

### PHILONOTIS, *Brid.*

(*Bartramidula,* Bryol. Europ.)

P. WILSONI, *B. et S.*
*Hab.* Clarence Peak, Fernando Po, alt. 8500 feet, *Mann.*

### BREUTELIA, *Schimp.*

B. GNAPHALEA, (Hypnum) *Beauv.*
*Hab.* Cameroons Mountain, alt. 12,000 feet, *Mann.*
The male flower has obtuse leaves; the fruit is not present.

B. DIFFRACTA, sp. nov. Laxe cæspitosa, caule ramoso, foliis e basi subquadrata superne latiore erecta subito divaricatis diffractisque

longe lanceolatis sensim tenuissime acutis plicatis, marginibus serrulatis, nervo tenui excurrente, cellulis ubique elongatis angustis papillatis, basi ad angulos paucissimis, circiter tribus majoribus fuscis, perichætialibus minoribus e basi ovata lanceolatis levioribus, theca in pedunculo semiunciali horizontali subglobosa plicata gymnostoma, operculo brevi conico.

*Hab.* Cameroons Mountain, alt. 5000–9000 feet, on rocks, *Mann.*

Differs from *B. gnaphalea* in its leaves having the upper portion suddenly divaricate, the cells in the erect base all narrow and elongate; in *B. gnaphalea* the cells occupying a considerable space on each side of the erect base are shorter and wider than in other portions of the leaf.

This is the first occurrence of a gymnostomous species in this group of Bartramiaceæ.

## BRYACEÆ, *Mitten.*

### MIELICHHOFERIA, *Hornsch.*

M. OVALIS, sp. nov. Dioica, cæspitosa, caule brevi radiculoso, foliis imbricatis erecto-patentibus ovatis acuminatis integerrimis, rarius apice denticulo uno alterove instructis, nervo percurrente, cellulis laxis teneris, perichætialibus ovato-lanceolatis, theca in pedunculo gracili pallido globoso-pyriformi, operculo conico, peristomio dentibus subulatis pallidis, annulo composito.

*Hab.* Cameroons Mountain, alt. 10,000 feet, *Mann.*

Stems scarcely half an inch high, in compact tufts of a pale shining yellow. In the form of its capsule allied to *M. Jamesoni*, Taylor, but it is a larger moss.

M. BASILARIS, *B. et S.*
*Hab.* Cameroons Mountain, alt. 7000–8000 feet, *Mann.*

### BRYUM, *Dill.*

### (*Bryum.*)

B. JULACEUM, *Sm.*
*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*
A few fragments with an *Anthoceros.*

B. ARGENTEUM, *L.*
*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

B. ALPINUM, *L.*
*Hab.* Cameroons Mountain, alt. 12,000 feet, *Mann.*

B. PALLESCENS, *Schwægr.*
*Hab.* Cameroons Mountain, alt. 7000–12,000 feet, *Mann.*
Specimens fine, and agreeing exactly with European and American states.

### (*Brachymenium.*)

B. FLEXIFOLIUM, *B. et S.*
*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

B. SUBERECTUM, sp. nov. Monoicum, *B. Nipalensi* simillimum, foliis e basi angustiore elliptico-spathulatis acuminatis, nervo in mucronem excurrente, marginibus ubique late cartilagineis a basi ad medium revolutis inde ad apicem remote serratis, cellulis parvis late oblongis, theca in pedunculo elongato inclinata pyriformi sub ore parvo constricta, operculo conico acuminato, peristomio *Brachymenii.*

*Hab.* Fernando Po, *Mann.*

Closely resembling *B. Nipalense,* but with leaves more narrowed at the base, more broadly marginate. The operculum acuminate, not hemispheric.

B. SUBULIFERUM, sp. nov. Monoicum, laxe cæspitosum, caule subsimplici, foliis laxe dispositis patentibus elliptico-lanceolatis nervo excurrente longe subulatis, marginibus a medio remote serratis, cellulis elongatis ad margines seriebus pluribus angustioribus limbum tenuem concolorem formantibus, theca in pedunculo elongato gracili suberecta pyriformi, peristomio *Brachymenii.*

*Hab.* Island of St. Thomas, lat. 0, *Mann.*

More nearly allied to *Brachymenium lanceolatum,* Hook. fil. et Wils, than to any yet known African or American species, and agreeing with it in size and general appearance; its leaves are, however, of a different form, having their widest part just above the middle, and thence gradually narrowing into the hair-like point.

## HYPNACEÆ, *Mitten.*

### FABRONIA, *Raddi.*

F. PERSOONII, *Schwægr.*

*Hab.* Island of St. Thomas, lat. 0, *Mann.*

Growing on a species of *Physcia* similar or perhaps identical with *P. speciosa.*

### HYPNUM, *Dill.*

### (*Brachythecium,* Schimp.)

H. VELLEREUM, sp. nov. Dioicum, cæspitosum, caule procumbente ramoso, foliis sericeo-nitentibus teretiuscule imbricatis late ovatis concavis subulato-acuminatis, acumine semitorto, nervo tenui medio evanido, marginibus apicem versus minute serrulatis, cellulis elongatis basi ad angulos parvis concoloribus quadratis, perichætialibus erectis ovato-lanceolatis, theca in pedunculo lævi cylindracea erecta æquali, operculo conico acuminato, peristomio interno processibus angustis perforatis in membrana ad tertiam partem dentium longitudinis exserta, ciliis nullis.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.* Abyssinia, near Ankober, *Dr. Roler.*

Habit and size similar to that of the more robust states of *H. salebrosum,* Hoffm., but leaves more turgid and faintly plicate. In the erect capsule and incomplete peristome, this species has the same ratio to *H. salebrosum* as *H. sericeum*, L., has to *H. lutescens*, Huds.

### (*Eurynchium*, Schimp.)

H. SPICULOSUM, sp. nov. Monoicum, caule laxe cæspitoso fruticoso, pinnatim ramoso, foliis patentibus flaccidis suborbiculari-ovatis acuminatis rameis oblongo-ovatis breviter acuminatis marginibus serrulatis, nervo ultra medium evanido, cellulis elongatis, perichætialibus e basi oblonga erecta subulato-attenuatis patulis, theca in pedunculo elongato spiculoso aspero rubro ovali horizontali, operculo subulirostrato, peristomio interno ciliis singulis inter processibus æquilongis perforatis in membrana ad dentium dimidium exsertis.

*Hab.* Cameroons Mountain, on trees, *Mann.*

Resembling *H. Swartzii*, Turner, but with more attenuated branches, more flaccid leaves, and removed from its near vicinity by the inflorescence, and thus more nearly agreeing with *H. remotifolium*, Grev., *H. speciosum*, Brid., and *H. austrinum*, Hook. et Wils., all which are more robust and less fruticose.

## METEORIUM, *Brid.*

M. SERRULATUM, (Pilotrichum) *Beauv.*

*Hab.* Fernando Po, *Mann.*

### (*Cryptotheca*, Hsch.)

M. INVOLUTIFOLIUM, sp. nov. Caule elongato arcuato pinnatim ramoso, foliis imbricatis patentibus oblongis panduriformibus profunde concavis convolutis obtusis apiculo brevi convoluto terminatis nitidis, enerviis integerrimis, cellulis elongatis basi fuscis, alaribus paucis parvis fuscis obscuris.

*Hab.* Sierra Leone, *Barter*; also in *Herb. Hooker.* from the same place, given by the Horticultural Society.

Stems three inches long, branches about one inch long, somewhat similar to *M. Vitianum*, Sullivant, but less rigid, and leaves more elongate and obtuse, and the apiculus is shorter.

M. IMBRICATUM, (Pilotrichum) *Beauv.*

*Hab.* Cameroons Mountain, alt. 4000–7000 feet; Clarence Peak, Fernando Po, alt. 8000 feet, on trees, *Mann.* Sierra Leone, *Barter.*

## TRACHYLOMA, *Brid.*

T. STIPITATUM, sp. nov. Ramis erectis dendroideis, stipite elongato, ramulis in fronde obliqua planiuscula dispositis, foliis hastatis compressis subquadrifariis substriatis late ovatis obtusis acutatis plicatis appressis, nervo tenui ad $\frac{3}{4}$ evanido, apice dorso prominente dentiformi, marginibus serrulatis, cellulis elongatis omnibus conformibus, floribus masculis gemmiformibus in ramis primariis secundariisque dispositis.

*Hab.* Fernando Po, alt. 7500 feet, *Mann.*

Very similar to the larger states of *T. arcuatum*, Hedw., but with the nerve abrupt below the apex of the leaf, and standing out as a small tooth.

### STEREODON, *Brid.*

### (*Pylaiesia*, Schimp.)

S. ABYSSINICUS, (Leptohymenium) *B. et S.*
*Hab.* Cameroons Mountain, alt. 7000–8000 feet, on trees, *Mann.*

### (*Theca pendula.*)

S. MOLLICELLUS, sp. nov. Dioicus, laxe late cæspitosus, ramis procumbentibus elongatis ramulis brevibus pinnatis, foliis falcatis secundis e basi latiore sensim angustatis lanceolatis, nervis binis fere obsoletis, apice parce serrulatis subintegerrimis, cellulis elongatis angustis, basi ad angulos paucis abbreviatis, foliis ramulinis circinatis integerrimis, perichætialibus elongatis lanceolatis subulatis serrulatis, theca in pedunculo longissimo gracili apice curvato ovali pendula.
*Hab.* Cameroons Mountain, alt. 4000–5000 feet, *Mann.*

Rather less, but habit and appearance similar to that of *S. ichnotocladus*, C. Müller; leaves of the ramuli more circinate and entire.

S. DIFFUSUS, sp. nov. Dioicus, late laxe cæspitosus, caule elongato depresso ramis brevibus pinnato, foliis compressis subsecundis e basi latiore sensim lanceolatis superne serrulatis nervis subobsoletis, ramulinis ovato lanceolatis, cellulis elongatis basi paucis abbreviatis, alaribus nullis, perichætialibus e basi ovato-lanceolata subulatis serrulatis, theca in pedunculo elongato gracili mutante, urceolata, peristomio magno, interno processibus solidis, ciliis binis subæquilongis interpositis in membrana ad ¾ dentium longitudinis exserta.
*Hab.* Prince's Island; Fernando Po, *Barter.*

Smaller than *S. mollicellus*, but with the same habit; leaves not so much narrowed upwards and serrulate, those of the ramuli not circinate, simply decurved, and also serrulate.

S. SCATURAGINEUS, (Hypnum) *Brid.*
*Hab.* Banks of the Nunn, and Fernando Po, *Mann*; Prince's Island, *Barter.*

S. BORBONICUS, (Hypnum) *Bel.*
*Hab.* Banks of the Nunn, *Mann.*

This small but most distinct moss is found intermixed with many other species from these regions.

S. PAPILLOSUS, (Hypnum) *Hornsch.*
*Hab.* Banks of the Nunn, on charred wood, *Mann.*

After comparison with original specimens from South America, no appreciable difference is observable.

S. PLANUS, (Hypnum).
*Hab.* Niger, *Vogel.*

S. **HOMALOPHYLLUS**, sp. nov. Monoicus, cæspitosus, caule vage subpinnato, foliis plano-compressis ovali-oblongis acutis obtusisve enerviis margine uno latere inflexo superne serrulatis, cellulis elongatis levibus alaribus utrinque tribus majoribus, perichætialibus ovato-lanceolatis serrulatis patulis, theca in pedunculo elongato-ovali collo curvato inclinata horizontalive, operculo conico acuminato, peristomio interno processibus solidis, ciliis singulis brevioribus interpositis in membrana ad $\frac{1}{3}$ dentium longitudinis exserta.

*Hab.* Niger, on roots in a rivulet, *Barter.*

Larger than *S. planus*, (*Hypnum*) Brid.; foliage more compressed, leaves with cells destitute of the papillæ so evident in that species.

### (*Plagiothecium*, B. et S.)

S. **NITIDIFOLIUS**, sp. nov. Monoicus, ramis ascendentibus ramosis, foliis patentibus compressis ovato-lanceolatis plerumque asymmetricis acutis integerrimis, nervis binis brevibus, angulis decurrentibus, cellulis angustis elongatis latitudine circiter $\frac{1}{4000}$ longitudine $\frac{24}{4000}$ uncii metientibus basi paucissimis laxioribus, perichætialibus erectis conformibus, theca in pedunculo gracili brevi ovali inclinata, operculo conico acuto, peristomio interno processibus ciliis binis brevibus interpositis, in membrana fere ad dentium dimidium producta.

*Hab.* Clarence Peak, Fernando Po, alt. 8000 feet, on trees, *Mann.*

Pale green, shining, in habit and size resembling *S. denticulatus*, Dill., but with leaves more evenly tapering into the more acute point, not acuminate, and cells half as wide, and nearly twice as long as in that species.

### (*Hylocomium*, Schimp.)

S. **FRUTICELLUS**, sp. nov. Monoicus, intricatus, caule erecto inferne simplici superne in frondem bipinnatim ramoso apice descendente radicante prolifero, foliis caulinis remotiusculis patulis hastato-acuminatis substriatis, rameis patentibus hastato-ovatis argutius serrulatis, dorso parce denticulatis, enerviis, cellulis elongatis angustis alaribus nullis, perichætialibus patentibus e basi late ovata subito longe subulatis integerrimis, theca in pedunculo longissimo apice curvato ovali æquali horizontali pendula, operculo brevirostrato, peristomio interno processibus solidis ciliis tribus dimidio brevioribus in membrana ad $\frac{2}{3}$ dentium longitudinis exserta.

*Hab.* Fernando Po, alt. 3000–8000 feet, *Mann.*

Habit and size that of *S. reptans*, Sw., but distinct in the more lanceolate point of the cauline and wider branch-leaves.

S. **FRONDOSUS**, sp. nov. Monoicus, intricate cæspitosus, caule superne bipinnato ramulis decurvis, foliis caulinis subsecundis latissime cordato-ovatis apiculo brevi curvato concavis margine hic illic plano minute serrulato, nervis binis teneris brevibus, cellulis elongatis angustis apicibus dorso prominentibus, rameis imbricatis late ovatis acuminatis concavis marginibus planis argute serrulatis, nervis longioribus, cellulis magis prominentibus basi paucis abbreviatis, perichætialibus e basi erecta ovata sensim lanceolato-attennuatis subintegerrimis patulis, theca in pedunculo longissimo rubro ovali inæquali horizontali pendulave, operculo conico longirostrato, peristomio interno processibus solidis ciliis singulis ejusdem longitudinis in membrana ad $\frac{1}{3}$ dentium longitudinis exserta.

*Hab.* Fernando Po, alt. 3000–8000 feet, on stones up the mountain, *Mann.*

Habit similar to that of *S. fruticellus* and *S. reptans*, but more robust, and approaching small states of *S. tenuis*, (*Neckera*) Hook. The capsule is sometimes regularly plicate, but not uniformly so. Very near to *S. pseudoreptans*, C. Müller, but different in capsule and peristome.

### LEPIDOPILUM, *Brid.*

L. DEVEXUM, sp. nov. Monoicum, caule parce ramoso, foliis compressis, lateralibus inæqualibus divaricato-decurvis asymmetricis intermediisque ovato-lanceolatis, mediis æqualibus minoribus, nervis ad medium productis, marginibus a medio ad apicem serrulatis paululum recurvis, cellulis longitudine latitudinem duplo superantibus, perichætialibus parvis ovatis acuminatis, theca in pedunculo gracili brevi bilineari rugoso apice flexo horizontali ovali, peristomio dentibus subulatis interno processibus carinatis angustis dentium longitudinis basi in membrana brevi exserta, calyptra sublævi subintegra.

*Hab.* Cameroons Mountain, alt. 4000 feet, *Mann.*

In size and appearance similar to *L. latifolium*, Müller, and the numerous closely allied South American species; but differing from all in its capsule being horizontal from the curvature of the very short seta, which is rugose, not papillose, and in the calyptra, which is more nearly smooth and entire than is usual in the genus.

L. VERSICOLOR, sp. nov. Monoicum, caule depresso ramoso, foliis compressis, lateralibus patulis subarcuatis oblongo-lanceolatis apice latiusculo acutis, mediis intermediisque paulo brevioribus sursum angustioribus acutioribus ad medium binervatis, cellulis oblongis mollibus inferne longioribus, marginibus apice dense serrulatis, perichætialibus brevibus lanceolatis pedunculo elongato gracili sub collo thecæ ovali-cylindraceæ horizontaliter ruguloso, operculo conico acuminato, peristomio interno processibus solidis ciliis nullis.

*Hab.* Fernando Po, *Mann.*

Near to *L. Utacamundianum*, Mont., but with narrower leaves and smaller cells.

## NECKERACEÆ, *Mitten.*

### NECKERA, *Hedw.*

### (*Climacium*, Mohr.)

N. LONGIROSTRIS, *Hook.*

*Hab.* Cameroons Mountain, alt. 7000 feet.

Very incomplete specimen, but not distinguishable from the South American species.

N. RAMULOSA, sp. nov. Gracilis, ramis bipinnatis, foliis compressis ovato-oblongis acuminatis ramulinis rotundato-ovatis, nervo ultra medium producto, marginibus a medio ad apicem argute subduplicato serrulatis, cellulis superioribus oblongo-rotundis inferioribus elongatis, perichætialibus apicibus subulatis.

*Hab.* Cameroons Mountain, alt. 4000 feet, amongst *Radula bipinnata*, Mann.

A slender species allied to *N. flagellacea*, Mitten, but with narrower leaves.

### (*Rhystophyllum*, Ehrh.)

N. DISTICHA, *Hedw.*
*Hab.* Fernando Po, *Mann.*

N. FOVEOLATA, *Mitten.*
*Hab.* Bagroo River, *Mann.*

N. PENNATA, *Hedw.*
*Hab.* Peak Clarence, Fernando Po, alt. 6000 feet, on trees, *Mann.*

N. REMOTA, *Bruch.*
*Hab.* Cameroons Mountain, alt. 7000 feet, on trees, *Mann.*
Agrees exactly with the Abyssinian specimens.

## LEUCODONTACEÆ, *Mitten.*

### HEDWIGIA, *Ehrh.*

### (*Hedwigium*, Schimp.)

H. IMBERBIS, *Hook. et Taylor.*
*Hab.* Cameroons Mountain, alt. 10,000–12,000 feet, on rocks, *Mann.*

H. RUPESTRIS, sp. nov. Monoica, cæspitosa, caule elongato ramoso, foliis caulinis erecto-patentibus imbricatis ovato-ellipticis acutis apice serrulatis marginibus inferne anguste reflexis longitudinaliter rugosis, rameis in apiculum flexuosum filiformem attenuatis, cellulis minutis rotundatis, perichætialibus erectis longioribus ovato-lanceolatis plicatis, theca in pedunculo semiunciali gracili late ovali pluries plicata, ore levi, operculo conico, rostro subulato, calyptra elongata bi- trifida uno latere profundiore pluries plicata.

*Hab.* Cameroons Mountain, alt. 10,000 feet, on rocks, *Mann.* "Ad rupes prope Enschedcap," inter cæspites *H. Schimperianæ*, No. 464, *Unio Ilmeraria*, 1842, *Schimper.*

Size about that of *H. Indica*, Mont., but in all the specimens less regularly branched; easily distinguished from *H. Schimperiana* by its more acute leaves and plicate capsule.

## LESKEACEÆ, *Mitten.*

### LESKEA, *Hedw.*

### (*Thuidium*, Schimp.)

L. INTRICATA, sp. nov. Monoica, intricate cæspitosa, caule phyllidiis brevibus sparsis, foliis patentibus latissime hastatis subulatis acuminatis minute serrulatis, nervo tenui in apice evanido, rami nudi, foliis hastato-ovatis acutis ramulinisque compressis ovatis obtusiusculis apiculo brevi, cellulis parvis rotundatis subobscuris papillis brevibus nervo sub apice evanido, perichætialibus erectis ovato-lanceolatis subulatis subintegerrimis lævibus, theca in pedunculo lævi elongato cylindracea subæquali suberecta, operculo subulirostrato, peristomio interno processibus elongatis in membrana brevi exserto, ciliis nullis.

*Hab.* Cameroons Mountain, alt. 7000 feet, on trees, *Mann.*

Allied to *L. Haplohymenia*, Hook, and to *L. leptoclada*, Taylor.

L. RAMUSCULOSA, sp. nov. Monoica, caule phyllidiis sparsis, foliis cauli latioribus latissime cordato-hastatis acuminatis, margine inferne planis superne crenulatis, nervo in apice evanido, ramis nudis, foliis late ovatis acutis, ramulinis ovatis obtusiusculis nervo sub apice evanido marginibus minute crenulatis, cellulis rotundatis obscuriusculis breviter papillosis, perichætialibus erectis e basi suboblonga superne dentato-lacera acumine subulato elongato serrulato, theca in pedunculo lævi elongato rubro horizontali cylindracea inæquali, peristomio interno processibus ciliis tribus interpositis in membrana ad ⅓ dentium longitudinis producta.

*Hab.* Clarence Peak, Fernando Po, *Mann.*

Larger than *L. versicolor*, Hsch., and different from any described species, with monoicous inflorescence in the laceration of its perichætial leaves; among the dioicous species this character is frequently observable.

### CALLICOSTELLA, *Mitten.*

C. AFRICANA, *Mitten.*

*Hab.* Fernando Po, *Mann.*

C. ABRUPTA, sp. nov. Dioica?, caule prostrato intricato gracili rigido, foliis oblongo-ovatis apice truncatis, nervis brevibus ad ¼ folii longitudinis productis, marginibus crenulatis, cellulis elongatis papillosis, perichætialibus oblongo-ovatis acutis, theca in pedunculo elongato cygnicolli flexu superne scabro ovali collo sensim attenuato pendula, operculo conico curvirostrato, peristomio interno processibus ciliis singulis brevioribus interpositis.

*Hab.* Fernando Po, *Mann.*

Less than its allies *C. cymbifolia*, Hampe, and *C. pallescens*, Hook. et Wils., but agreeing with them in the shortly nerved leaves.

### RHACOPILUM, *Brid.*

**R. MUCRONATUM**, *Beauv.*
*Hab.* Fernando Po, *Barter.*

**R. AFRICANUM**, sp. nov. Dioicum, habitu staturaque *R. tomentosi*, foliis lateralibus ovalibus, nervo in mucronem excurrente, marginibus serrulatis, cellulis oblongis rotundisque distinctis viridibus, tegminalibus parvis e basi hastata subulatis serrulatis cellulis minoribus, perichætialibus teneris e basi latiore subito subulatis integerrimis, theca in pedunculo elongato trigono inclinata subhorizontali elongata plicata ore obliquo, operculo subulato rostrato, peristomio magno normali, calyptra pilosa dimidiata.
*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

Rather larger, but nearly resembling *R. tomentosum*, Schw. Capsule longer, and inflorescence different.

## MNIACEÆ, *Mitten.*

### FISSIDENS, *Hedw.*

**F. VIRIDULUS**, *Schw.*
*Hab.* Cameroons Mountain, alt. 7000 feet, on rocks, *Mann.*

**F. MICROCARPUS**, sp. nov. Monoicus, caule ramoso, foliis patentibus late lanceolatis obtusiusculis subundulatis, nervo pellucido sub apice evanido, lamina folii vera ad medium producta æquali, dorsali basi contracta non decurrente, omnium laminarum marginibus tenuissime crenulatis, cellulis distinctis diametro circiter $\frac{1}{3000}$ unciæ metientibus, theca in pedunculo gracillimo pallido minute ovali tenera erecta æquali, operculo subulato, peristomio dentibus brevibus subintegris dicranisque, calyptra mitriformi subscabra.
*Hab.* Banks of the Nunn, in large patches on bark, *Mann.*

Very near to *F. sciophyllus*, Mitten; but leaves more obtuse, not obscure; cells easily distinguished; capsule quite symmetric.

### RHIZOGONIUM, *Brid.*

**R. SPINIFORME**, *L.*
*Hab.* Fernando Po, *Mann.*

### MNIUM, *Dill.*

**M. ROSTRATUM**, *Schw.*
*Hab.* Fernando Po, *Mann.*

### DALTONIA, *Hook. et Tayl.*

**D. PATULA**, sp. nov. Monoica, foliis patentibus late lineari-lanceolatis nervo ad $\frac{3}{4}$ evanido carinatis, margine e serie triplici cellularum elongatarum integerrimo, cellulis omnibus parvis rotundato-ovalibus pellucidis latitudine circiter $\frac{1}{3000}$ longitudine $\frac{6}{3000}$ unciæ metientibus, peri-

chætialibus parvis ovatis, theca in pedunculo rubro-fusco papilloso inclinata obovata, operculo subulato longi-rostrato, calyptra fimbriata.

*Hab.* Clarence Peak, Fernando Po, alt. 7000 feet, with *Neckera pennata*, Hedw., *Mann.*

Similar to *D. marginata*, Griff., and to *D. ovalis*, Tayl. Cells small and short.

D. LONGINERVIS, sp. nov. Monoica, foliis patentibus siccitate substrictis angustis lanceolatis nervo sub apice evanido carinatis, margine e serie superne quadruplici inferne latiore cellularum elongatarum integerrimo, cellulis superioribus latitudine circiter $\frac{1}{4000}$ longitudine $\frac{3}{2000}$ unciæ metientibus, inferioribus elongatis angustis, theca in pedunculo brevi rubro-fusco superne papilloso ovali ad medium papillosa, operculo subulato rostrato, calyptra fimbriata.

*Hab.* Fernando Po, with *Lepidopilum devexum*, Mann.

Like *D. angustifolia*, Dzy. et Molk., but with the cells at the base of the leaf much longer; it is a larger species than *D. splachnoides*.

D. SPLACHNOIDES, *Hook. et Tayl.*

*Hab.* Clarence Peak, Fernando Po, with *Stereodon nitidifolius*, Mann.

Two or three stems only, which appear to correspond with the Irish species.

### DISTICHOPHYLLUM, *Dzy. et Molk.*

D. PROCUMBENS, sp. nov. Monoicum, caule brevi procumbente, foliis lateralibus patentibus late spathulatis apice rotundatis, intermediis erecto-patentibus mediisque erectis oblongo-spathulatis, omnibus apice apiculo parvo terminatis, margine tenui limbatis, nervo tenui ultra medium evanido, cellulis superioribus rotundatis diametro circiter $\frac{1}{1000}$ unciæ metientibus, inferioribus oblongis, perichætialibus parvis obtusis, theca in pedunculo bilineari aspero minuta globoso-ovali collo elongato horizontali, operculo e basi conica tenui longe subulato, calyptra basi longe fimbriata.

*Hab.* Fernando Po, *Mann.*

Stems about half an inch high; leaves pale yellowish green, becoming brown in age. Nearly allied to *D. spathulatum*, Dzy. et Molk.

*Mniadelphus*, C. Müller, must give place to *Distichophyllum*, on account of its priority.

### CYCLODICTYON, gen. nov.

*Caulis* repens, ramosus. *Folia* binervia, cellulis rotundis lævibus. *Fructus* lateralis. *Calyptra* mitriformis.

C. LÆTEVIRENS, (Hookeria) *Hook. et Tayl. Muscol. Brit. et auctorum.* Pterygophyllum ex parte, *Bridel.*

*Hab.* Clarence Peak, Fernando Po, alt. 8000 feet, on trees, *Mann.*

This genus is proposed to include a small group of species, all closely agreeing in habit and structure with *C. lætevirens*. They differ from the *Hookeria* founded by Smith on *H. lucens*, and from *Lepidopilum*, Schw., in the large rounded cells of their leaves. In this particular they agree with that group of species which correspond with the *Hookeria quadrifaria*, Hook. Musc. Exot. t. 109, and which have been described in the Antarctic Floras under Bridel's genus *Pterygophyllum*; but the habit is different and the entire appearance of the plants dissimilar.

## HYPOPTERYGIACEÆ, *Mitten.*

### HYPOTERYGIUM, *Brid.*

H. LARICINUM, *Hook.* (*quoad specimina Menziesiana*).
*Hab.* Fernando Po and Island of St. Thomas, *Mann.*
The inflorescence of this species is monœcious.

## POLYTRICHACEÆ, *Schimp.*

### POLYTRICHUM, *Dill.*

### (*Cephalotrichum*, B. et S.)

P. SIMENSE, *B. et S.*
*Hab.* Cameroons Mountain, alt. 8000–10,000 feet, on the ground, *Mann.*

### (*Eupolytrichum.*)

P. JUNIPERINUM, *Hedw.*
*Hab.* Cameroons Mountain, alt. 8000–10,000 feet, *Mann.*

P. COMMUNE, *L.*
*Hab.* Clarence Peak, Fernando Po, on the very summit, *Mann.*

## *HEPATICÆ.*

### JUNGERMANNIA, *L.*

J. DENTATA, *Raddi.*
*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

J. HIRTELLA, *Weber.*
*Hab.* Cameroons Mountain, alt. 7000 feet, amongst *Dicranum ericetorum*, Mann.

J. ABYSSINICA, *Nees ab E.*
*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

J. GEMINIFOLIA, sp. nov. Caule gracili repente, foliis oppositis directione divergentibus devexisque convexis ambitu ovatis obtusis, margine dorsali subrecto ventrali magis arcuato apice rotundato basi dorso ventreque connexis, cellulis grossiusculis intercalaribus distinctis.
*Hab.* Island of St. Thomas, creeping on *Sendtnera diclados*, Endl., *Mann.*

Very closely resembling *J. perfoliata*, Sw., in size, but apparently different in its more closely inserted leaves, which are more divaricate and more unequal-sided.

### PLAGIOCHILA, *Nees et Mont.*

P. SQUAMULOSA, sp. nov. Ramis elongatis subpinnatim ramosis apice decurvis, foliis patentibus imbricatis subdeltoideis apice obtusis, margine dorsali inferne integerrimo recurvo arcuato apice totoque marginis ventralis denticulato, ubi in caule descendente crispulo squamulis amphigastriiformibus varie lacerulis, cellulis rotundatis æqualibus, perianthio obovato dorso alato, labiis rotundatis denticulatis, foliis involucralibus latioribus undulatis argutius dentatis.

*Hab.* Cameroons Mountain, alt. 7000–8000 feet, *Mann.*

Resembles *P. corrugata*, Nees ab E.; but the leaves are more rigid, undulated only at the base, and the margin more strongly toothed.

P. DICHOTOMA, *Nees ab E.*

*Hab.* Cameroons Mountain, alt. 4000 feet, *Mann.*

### LEIOSCYPHUS, *Mitten.*

L. REPENS, sp. nov. Caule repente ramoso radiculoso, foliis explanatis late ovato-subrotundis apice rotundatis sinuve obtuso bidentatis basi cum amphigastrio sinu lato bidentato, dentibus intus uni- extus bi-denticulato uno latere coalitis, cellulis rotundatis limitibus tenuibus, intercalaribus distinctis, foliis involucralibus magis rotundatis apice subbidentatis basi saccatis, amphigastrio caulinis majore magis dentato, perianthio basi turgido apice compresso lævi, labiis breviter dentatis.

*Hab.* Clarence Peak, alt. 8000 feet, Fernando Po, on decayed wood, *Mann.*

Entire plant, including the peduncle and rootlets, dark brown. In size similar to *Lophocolea heterophylla*, Nees ab E.

### LOPHOCOLEA, *Nees ab E.*

L. DEVEXA, sp. nov. Caule elongato parce ramoso, foliis sursum conniventibus directione (explanatis) devexis ovatis ovato-oblongisque margine ventrali rectiusculo integerrimo dorsali arcuato basin versus uni- bidentato, amphigastriis satis magnis late ovatis apice breviter bidentatis lateribus utrinque angulato-bidentatis, cellulis subrotundis, interstitiis grossis.

*Hab.* Island of St. Thomas, creeping on *Sendtnera diclados*, Endl., *Mann.*

Resembling very nearly *L. trapezoides* (*Chiloscyphus*), Nees ab E., but leaves more narrow.

L. COADUNATA, *Sw.*

*Hab.* Prince's Island, *Barter.*

L. BIDENTATA, *Nees ab E.*

*Hab.* Clarence Peak, Fernando Po, alt. 8000 feet, on trees, *Mann.*

L. MURICATA, Nees ab E.

*Hab.* Clarence Peak, Fernando Po, alt. 8000 feet (a few fragments only), *Mann.*

### GYMNANTHE, *Tayl.*

G. DECIPIENS, (Jungermannia) *Hook.*

*Hab.* Peak Clarence, Fernando Po, alt. 8000 feet, *Mann.*

The habit and structure of this species seem to bring it more nearly to this genus than to *Plagiochila,* to which it was referred in the 'Synopsis Hepaticarum.'

G. BILOBA, sp. nov. Caule procumbente radiculoso apice sæpe stolonifero descendente curvato, foliis sursum conniventibus explanatisve, subobcordatis bilobis sinu subrectangulo lobis subovatis acutis rarius trilobis, cellulis rotundatis interstitiis crassiusculis.

*Hab.* Clarence Peak, Fernando Po, alt. 8000 feet, *Mann.*

Smaller than the preceding species and more creeping, but appearing to belong to the same genus.

### LEPIDOZIA, *Nees ab E.*

L. SUCCIDA, *Mitten.*

*Hab.* Fernando Po, *Mann.*

### PHYSIOTIUM, *Nees ab E.*

P. SPHAGNOIDES, *Hook.*

*Hab.* Island of St. Thomas, *Mann.*

### SENDTNERA, *Nees ab E.*

S. JUNIPERINA, *Sw.*

*Hab.* Island of St. Thomas, *Mann.*

S. DICLADOS, *Endl.*

*Hab.* Fernando Po, *Mann.*

### RADULA, *Nees ab E.*

R. BIPINNATA, sp. nov. Ramis elongatis bipinnatis rigidis ramulis divergentibus, foliis laxe imbricatis suborbiculatis apice obtusis obtuso-angulatisve lobulo parvo cauli transverse appresso basi auriculo latiusculo rotundato infra punctum insertionis descendente ambitu cordato angulo superiore obtuso, cellulis minutis rotundatis subobscuris, perianthio in ramis laterali parvo brevi labiis undulatis, capsula emergente.

*Hab.* Cameroons Mountain, alt. 4000 feet, *Mann.*

Branches three to four inches long, slender, and rigid. Perianth remarkably small.

R. TAMARISCINA, sp. nov. Caule gracili rigidulo ramis divergentibus bipinnato, foliis divergentibus late ovatis apice rotundatis lobulo parvo subquadrato rectangulato basi trans caulem protracto, cellulis parvis rotundatis.

*Hab.* Island of St. Thomas, on *Physiotium sphagnoides,* Hook., *Mann.*

A small brown species, agreeing in size, appearance, and ramification with *Frullania tamarisci,* N. ab E.

R. VOLUTA, *Tayl.*
*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

### MADOTHECA, *Dumort.*

M. SUBDENTATA, sp. nov. Ramis dense pinnatim ramosis, foliis divergentibus oblongis margine ventrali paulo sinuatis apice denticulatis, lobulo oblongo spinuloso dentato basi auriculato, amphigastriis breviter ovatis apice denticulatis, perianthio ovato apice truncato ore dentato.
*Hab.* Cameroons Mountain, alt. 4000 feet, *Mann.*

Differs from *M. capensis*, Gottsche, in the denticulate leaves, lobule, and amphigastrium, and smaller cells. In size near to *M. platyphylla.*

### LÉJEUNIA, *Gottsche et Ldbg.*

### (*Thysananthus*, Ldbg.)

L. TRIQUETRA, sp. nov. Caule dichotomo subpinnatove ramoso, foliis ovatis apice angulo subrecto acutis dentatis, margine dorsali subrecto, ventrali incurvo arcuato, lobulo parvo oblongo bidentulo, amphigastriis obovatis apice emarginatis subdentatis marginibus inferne recurvis, cellulis parvis ovali-rotundis, foliis involucralibus majoribus apice obtusioribus magis dentatis, amphigastrio magno apice dentato, perianthio triquetro angulis superne dentatis.
*Hab.* Bagroo River, on bark, *Mann.*

Similar in size and appearance to *L. spathulistipa* (*Thysananthus*), Ldbg.; but leaves more obtuse, less sharply toothed, and the lobule bidentate.

### (*Phragmicoma*, Dumort.)

L. PAPPEANA, (Phragmicoma) *Nees ab E.*
*Hab.* Fernando Po, *Mann.*

L. ABBREVIATA, sp. nov. Cæspitosa depressa, ramis brevibus subsimplicibus, foliis decurvis oblongis apice rotundatis margine ventrali sinuatis basi lobulo parvo oblongo unidentato, cellulis parvis rotundatis, amphigastriis parvis oblatis suborbiculatisve integerrimis, foliis involucralibus conformibus, perianthio subterminali obovato compresso dorso uni- ventre bi-carinato, angulis lævibus.
*Hab.* Bagroo River, on bark, *Mann.*

A small brownish-green species, with branches about three lines long and scarcely a line wide. It resembles in form *L. Sagræana*, Mont., and *L. adplanata*, but is more rigid.

L. MONTAGNEI, *Gottsche.*
*Hab.* Island of St. Thomas, on *Sendtnera diclados*, Endl., *Mann.*

### (*Lejeunia*, G. et L.)

L. ACUTA, sp. nov. Caule repente elongato ramoso, foliis patulis ovatis acuminatis acutis, cellulis rotundis pellucidis, lobulo parvo saccato unidentato, amphigastriis rotundo-ovatis sinu angusto laciniis conniventibus acutis, foliis involucralibus conformibus, perianthio parvo terminali obovato superne quinquangulato carinis sublævibus.

*Hab.* Fernando Po, on lichens, *Mann.*

Pale yellow. Similar to *L. cerina*, L. et L., and its allies.

(*Acrogonia*, Mitt.)

L. CULTRELLA, sp. nov. Epiphylla maculas astroideas formans, foliis patentibus ambitu subellipticis margine dorsali arcuato subintegerrimo ventrali dentato subintegerrimove dente uno validiore supra apicem lobuli oblongi apice rotundati, amphigastriis ad basin in lacinias duas angustas divergentes divisis, perianthio suboblongo angulis brevibus acutis divaricatis, foliis involucralibus inæqualiter bilobis subdentatis amphigastrio oblongo breviter bidentato.

*Hab.* Cameroons River, on leaves, *Mann.*

Nearly allied to *L. cupulata*, Tayl., and resembling it in the form of the leaves, which are, however, less narrowed upwards, and the lobule is more oblong.

## FRULLANIA, *Raddi.*

F. EMERGENS, sp. nov. Caule procumbente vage subpinnatim ramoso, foliis imbricatis suborbiculatis apice incurvis, auriculo galeato compresso appendiculo magno descendente lævi, amphigastriis orbiculatis basi cordatis magnis breviter emarginatis, marginibus incurvis planiusculis, fructu terminali, foliis involucralibus cum amphigastrio coalitis apice paucidentatis, perianthio vix emergente oblongo acuminato compresso pluricarinato, carinis apice subundulatis.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

Closely allied to *F. Mundiana*, Ldbg. et G., and *F. hians*, L. et L., but more robust, scarcely pinnate, leaves more orbicular, amphigastria not undulated.

F. DEPRESSA, sp. nov. Caule procumbente vage pinnato, foliis imbricatis oblongo-orbiculatis apice incurvis, lobulo galeato compresso, appendiculo infra basin non producto, amphigastriis imbricatis rotundatis basi paulo angustioribus breviter emarginatis, marginibus incurvis, involucralibus cum amphigastrio oblongo subligulato breviter bifido coalitis apice acutis integerrimis, perianthio oblongo apiculato exserto compresso, dorso lævi, ventre bicarinato.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

Approaches more nearly to *F. gibbosa*, Nees ab E.; but the margin of the leaf does not descend below the lobule, and the amphigastria are different.

F. CORDATA, sp. nov. Ramis gracilibus rigidis strictis pinnatis ramulis brevibus patulis recurvis parce ramosis, foliis caulinis subdivergentibus suborbiculatis obtusis mucrone parvo incurvo basi cordato-auriculatis, marginibus integerrimis incurvis, lobulo parvo elongato cauli contiguo ad medium evoluto amphigastriis suborbiculatis basi cordatis appressis ad medium fere bifidis laciniis acutis marginibus ubique recurvis tecto, cellulis apice foliorum parvis rotundis medio oblongis ad insertionem majoribus hexagonis omnibus crasse limbatis, perianthio compresso dorso lævi ventre unicarinato, foliis involucralibus lobis oblongo-lanceolatis dentato-laceris.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

In size and habit allied to *F. cordistipula,* Nees ab E. The lobule in the ramuli more remote from the stem, and not covered by the amphigastrium.

F. ANGULATA, sp. nov. Ramis gracilibus flexuosis rigidis, ramulis remotis elongatis simplicibus pinnatis, foliis directione patentibus cauli involutis ovatis acutis, marginibus angulis obtusis subdentatis, cellulis rotundis intercalaribus distinctis basi paucis majoribus, lobulo angusto evoluto cauli contiguo, amphigastriis oblongis bifidis sinu laciniisque acutis marginibus recurvis medio carinatis basi auriculis parvis cordatis, perianthio compresso dorso lævi ventre unicarinato, foliis involucralibus amphigastrioque laciniis lanceolatis angulosis.

*Hab.* Cameroons Mountain, alt. 8000 feet, *Mann.*

Very near to *F. atrata,* N. ab E., but leaves more ovate and angulate.

F. SQUARROSA, *Nees ab E.*

*Hab.* Prince's Island, *Mann.*

### PLAGIOCHASMA, *L. et L.*

P. AITONIA, *Ldbg. et Nees.*

*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

### DUMORTIERA, *N. ab E.*

D. HIRSUTA, *Schw.*

*Hab.* Cameroons Mountain, alt. 4000 feet, Fernando Po, *Mann.*

### TARGIONIA, *Raddi.*

T. HYPOPHYLLA, *L.*

*Hab.* Cameroons Mountain, alt. 7000 feet, with *Plagiochasma Aitonia,* Mann.

### DENDROCEROS, *N. ab E.*

D. CRISPATUS, *N. ab E.*

*Hab.* Island of St. Thomas, *Mann.*

### ANTHOCEROS, *Micheli.*

A. DICHOTOMUS, *Raddi.*

*Hab.* Cameroons Mountain, alt. 7000 feet, *Mann.*

## Letter from W. ARCHER, Esq., F.L.S., to Sir W. J. HOOKER, F.R.S., &c., on Tasmanian Tree Ferns.

[Read Nov. 19, 1863.]

Cheshunt, Deloraine, Tasmania,
September 22, 1863.

MY DEAR SIR WILLIAM,—I fully intended to write to you a long letter by this post, giving you information upon various points which I thought might prove interesting to you. The arrival of a visitor, to whom I had to give up most of my leisure, has deprived me, however, of the time which I should have devoted to the letter to you. I must therefore content myself with a brief account of the very remarkable fern trees which grow on the northern side of the mountain called Cumming's Head (or more properly Cummings's Head), on land adjoining my estate.

In the midst of a damp forest of gum-trees of various species, and among trees of the genera *Pomaderris*, *Pittosporum*, *Eurybia*, &c., are to be found many fern trees of the genus *Dicksonia*—the *Dicksonia antarctica* being the species growing there. Many of them have more than one crown; but there is one fern tree in particular, round the circumference of whose top I *counted* no fewer than nineteen crowns, and I calculated that within the circumference there must be half as many more, making about twenty-eight or twenty-nine crowns in all. I considered this the most wonderful fern tree in the world when I first saw it, and roughly estimated the number of crowns at fifteen or sixteen. Now I am satisfied that it is one of the wonders of the world. Well do I remember the smile of incredulity with which many Fellows of the Linnean Society at one of the meetings received my statement that I had seen a fern tree with ten crowns (for I heartily dislike exaggeration); but I hope that my excellent friend your son will take an opportunity of confirming my statement by my account written on the spot.

Strange to say, there is another fern tree of the same species near the former one, round the circumference of whose top I counted, just the other day, seventeen crowns, which would give a total of twenty-five. There are also two others within twenty or thirty yards of it, the one with seven and the other with six crowns. The fern tree with twenty-five crowns is a very singular one; for it seems to have been originally about sixteen feet high, and to have fallen, and broken at a height of nine feet from the ground, and then to have shot up straight from the fracture. It now stands about eight or nine feet high. W. ARCHER.

## Memorandum on a presumed case of Parthenogenesis in *Zanthoxylum alatum*, Roxb. By DANIEL HANBURY, Esq., F.L.S.

[Read Nov. 19, 1863.]

IN January last Dr. Anderson brought under the notice of the Linnean Society a presumed case of parthenogenesis in a species of *Aberia*, a shrub of which, in the Botanic Gardens of Calcutta, bore a large crop of well-ripened fruits containing fertile seeds, though only pistilliferous flowers could be detected at the time of flowering.

A case of similar character has come under my own notice: an Indian species of *Zanthoxylum*, the *Z. alatum* of Roxburgh, a diœcious plant, flowered in my father's garden at Clapham in the spring of 1862. As I had examined the flowers without being able to detect stamens, and knew that no other plant of the same genus grew near, I was not a little surprised to find the ovaries swell and the berries attain their full development,—and still more so when, having carelessly placed three or four seeds in a pot of earth, a seedling *Zanthoxylum* made its appearance.

In the spring of this year the shrub, now removed from the conservatory to the open border, again flowered, and though subjected to a much more careful scrutiny than previously, I failed to discover upon it any other than pistilliferous flowers. Still the ovaries became enlarged, and the shrub again bears mature berries, some of which I now exhibit to the Society.

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## On the Plants of the Temperate Regions of the Cameroons Mountains and Islands in the Bight of Benin; collected by Mr. GUSTAV MANN, Government Botanist. By J. D. HOOKER, M.D., V.P.R.S. & L.S.

[PLATE I.]

[Read Nov. 5, 1863.]

THE last few years have been fruitful in contributions to our knowledge of the botany of the least known, and in the present state of science, most interesting portion of the globe, namely the interior and mountains of tropical Africa. The collections of

Welwitsch in Loanda, of Kirk and Meller during Livingstone's Expedition, of Vogel and Petherick in the White Nile region and Nubia, of Baikie and Barter in the Niger Valley, of Speke and Grant in their arduous journey through Eastern tropical Africa, and lastly of Gustav Mann on the shores, islands, and mountains of the Bight of Benin, are all of great extent, and abound in novelty and interest.

It is with the highest satisfaction that we have lately welcomed amongst us the first-named of these adventurous explorers, Dr. Welwitsch, who is charged by the King of Portugal with a mission to this country for the purpose of preparing his collections for publication; and it only remains for us to hope that the exertions now being made by Sir W. Hooker to induce the British Government to follow the example of His Majesty of Portugal, in securing the publication of our own collections, will be successful, and that the botanical results of so many expeditions, brought together at such great cost and at so great a sacrifice of life, may not be doomed to lie unpublished in our museums for want of the trifling sum requisite for rendering them available to science.

It is with the collections of Mr. Mann that I now propose to occupy the attention of the Society; and with but a small portion of them; for the general collection, amounting to several thousand species, would take many months of continuous labour to investigate fully and report upon. The whole of these, however, having been transmitted to Kew, partly by Earl Russell as Chief Secretary for Foreign Affairs, under whose auspices Mr. Mann first went to Africa, and partly by the Lords of the Admiralty, under whom his latter explorations were conducted,—I have felt it to be my duty to lay before this Society, with the least possible delay, an account of those portions of them which are most novel and interesting. These are, the forms of the temperate mountain-regions explored.

In the sixth volume of our Journal, the Society printed a brief account of the collections made by Mr. Mann in the upper regions of the lofty peak (Clarence Peak) which crowns the Island of Fernando Po, which I had the honour of laying before them. The very great interest of that Florula rendered it in the highest degree desirable that Mr. Mann should completely explore all those mountains of the Bight of Biafra, both insular and continental, which rise into the temperate region, and especially the Cameroons Peaks, which had never been ascended by any European, and which Mr. Mann, from the period of his first arriving on the coast of Africa, had resolved to scale at all hazards. The great scientific importance of the expedition having been represented by Sir W. Hooker to the Duke of Somerset, First Lord of the Admiralty (to which department of the Public Service Mr. Mann had then been transferred), thanks to that nobleman's enlightened views and to the late lamented Admiral Washington's recommendations, the necessary funds were provided; and in this as in his other expeditions Mr. Mann's exertions have been crowned with far greater success than has been the lot of any previous explorer of the West-African coast, Dr. Welwitsch alone excepted. It is not my purpose here to enter into any detail of the many difficulties and dangers, the privations, and all but fatal fevers that Mr. Mann, in common with every other explorer of the shores of the Bights of Benin and Biafra, has encountered; by prudence, temperance, and energy all have been successfully combated; and he has returned to this country, after upwards of three years' continuous journeyings in the most fatal climates in the world, in excellent health, and with the finest collections, whether as regards extent, or interest, or excellent preservation, that have ever been made in those regions.

Before proceeding to an account of the mountain plants collected, it is expedient to enumerate the localities and their elevations, and to record the dates, &c. of the several expeditions during which they were gathered.

*Peak of Fernando*, elevation 9469 ft. First ascent attempted on the east side, February 21st, 1860; reached 2000 ft. and was driven back by the natives. Second ascent, from the north side, commenced March 22nd; reached the summit April 3rd; descended April 13th. November 7th, attempted a third ascent; but on the 23rd, being deserted by his servants, descended. December 7th, made a fourth attempt, and reached the summit for the second time on the 5th; descended on the 21st. March 19th, 1862, started for the fifth time to ascend the Peak, reaching the summit for the third time; returned on the 25th March, after measuring the depth of the great crater on the summit (515 ft.). April 12th, 1862, made the sixth ascent; reached the summit on the 16th, and descended on the 23rd. March 5th, 1863, made the seventh ascent, reached the summit on the 8th, and descended on the 13th.

*St. Thomas's Island* was visited August 5th, 1861. On the 13th commenced the ascent of the Peak, whose summit (alt. 7500 ft., according to the Admiralty charts) was reached on the 22nd; left on the 26th. The loftiest part of the island consists of a very narrow ridge, and is accessible with great difficulty from the east side, from which side Mr. Mann attempted it. A species of *Podocarpus* was the most remarkable discovery. Robert Brown having long ago remarked the absence of Coniferæ in West tropical Africa, this discovery was of especial interest. The species is very nearly allied both to a Cape and to an Abyssinian one. Here also the magnificent *Musa Sapientum* var. *vittata* was discovered in a cultivated state, and living specimens sent to Kew (see Bot. Mag. t. 1510–1513). It is, according to Mr. Mann, a native of the Gaboon.

*Prince's Island* was visited on September 22nd, and left on October 26th.

*Cameroons Mountains.*—This noble group attains 13,100 ft. of elevation, and consists of many peaks, all of volcanic origin, crowning an irregular short littoral range. Some of the physical characters of the group have been described in a memorandum transmitted to the Secretary of State for Foreign Affairs by Consul Burton, who accompanied Mr. Mann on his second visit to this group. The account there given of this adventurous expedition seeming to imply that it was one planned and conducted by Consul Burton, to which Mr. Mann had attached himself, I have been desired by Mr. Mann to publish the accompanying statement of the facts of the case as communicated by himself:—

"January 7th, 1861.—Having been instructed to use every exertion to explore the Cameroons Mountains, I arrived at Ambas Bay * (the foot of the range), on a reconnoitring expedition, hoping to ascend if possible, but chiefly with the view of making arrangements for ascending at an earlier period during the following season. February 10th, ascended the mountains to the highest villages, Makunda and Bando; elevation about 2500 ft.; but being under orders to repair to the Bagroo River, to report on its timbers for the Admiralty, before the wet season set in, I was obliged to descend, having arranged to revisit the mountain in the ensuing season.

"December 13th, 1861, I left Victoria, the Baptist Missionary station, in Ambas Bay, and reached Bassumba, alt. 1119 ft. On the 15th arrived at Mapanya, alt. 2748 ft.; on the 17th camped at a spring at the base of the Peaks, above the forest, at 7376 ft. On the 18th ascended to the summit of one of the highest peaks (Mount Helen), alt. 9290 ft., and returned to Mapanya, where I was met on the following day by Mr. Saker, Signor Calvo, and Consul Burton, who, having followed me up the mountain, now joined my expedition. December 24th, again visited Mount Helen. January 3rd, 1862, reached the summit of the Cameroons Mountains—Mount Albert, alt. 13,100 ft., which had never before been visited by a European; was taken ill on the descent, and had to be carried down to Victoria. January 24th, again left Victoria for the mountains, and reached the top of Mount Victoria, alt. 12,861 ft., on the 29th, Mount Albert (my second visit), and Mount Hooker. On January 31st, Consul Burton descended, leaving me: I continued my explorations till February 18th.

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* "This was nine months before Consul Burton arrived on the coast of Africa."

" November 8th, 1862, left Victoria for a third expedition on the mountains, visited the summit twice, and returned to Victoria December 15th. On this occasion I examined the 'Burning Field' described by Consul Burton in his Report printed by the Foreign Office, and found the appearance to be caused by steam issuing from the ground, at an elevation of 12,967 ft. above the sea. December 30th, ascended Mount Etindet, alt. 5309 ft."

From Mr. Mann's descriptions, the Cameroons Mountains present a dense forest-region up to about 7000 ft., when open grassy fields succeed, with bushes of *Hypericum*, *Pittosporum*, *Adenocarpus*, *Pygeum*, *Leucothoë*, *Ericinella*, *Myrica*, and various herbaceous plants. The many peaks which rise above this elevation are either stony and barren (being all formed of lava scoriæ or basalt), or are dotted with tufts of grass and a few other herbaceous plants.

The most interesting plants from the highest summits are, *Umbilicus pendulinus*, *Silene*, *Trifolium*, *Galium Aparine* and *G. rotundifolium*, *Scabiosa succisa*, *Helichrysa*, *Veronicæ*, *Bartsia*, *Stachys*, *Trichonema Bulbocodium*, *Deschampsia cæspitosa*, *Poa nemoralis*, *Kœleria cristata*, and various other European and even British plants.

*Sierra del Crystal.*—This appears to be a low range of hills, nowhere exceeding 2000 ft. elevation, whose importance and altitude have, according to Mr. Mann, been much overrated by M. du Chaillu. On June 7th, 1862, Mr. Mann reached the Gaboon River, and on the 12th arrived at Corisco Bay (Ilobi Island). On the 4th July left Corisco for the interior hills; on the 13th reached the summit of Mount Maveya, alt. 1668 ft., erroneously supposed to be 5000 ft. high and the summit of the chain. The true summit is Mount Shomba, alt. 1767 ft. On the 28th, having crossed the Sierra, he reached the village of Mangetsi, about eighty miles in a straight line from the coast.

Mr. Mann desires publicly to express his great obligations to the various Spanish and Portuguese officials on the coast, and especially to Consul Hutchinson at Fernando Po, and to the Missionaries at Victoria (Ambas Bay), the Revs. Messrs. Saker and Smith, but for whose cordial aid the Cameroons Mountains could not have been successfully explored by any European at the time of his visit. At Corisco he was much indebted to Mr. Mackey of the American Mission, who rendered him active and essential service.

The number of plants collected during these and Mr. Mann's other expeditions on the coast, amounts to probably 3000 flowering species, of which 237, found at elevations above 5000 ft., are those with which I propose to deal in the present paper. Nearly half of this number (viz. 112) are new species, and upwards of half are from the Cameroons Peaks.

Excluding the few peculiar to St. Thomas's and Prince's Islands, we have on the Cameroons Mountains, at elevations above 5000 ft., 203 species, and on Fernando Po Peak 102, of which 68 are common to both localities. The Monocotyledons bear a larger proportion to the Dicotyledons on the Cameroons (1 : 2·3) than on Fernando Po Peak (1 : 3·2). The proportion of nondescript to the previously known species was nearly the same on the Cameroons (1 : 2·2) as on Fernando Po (1 : 2·3); but of the plants common to both localities the proportion of novelty is much smaller (1 : 2·8).

I have adopted the above-mentioned altitude of 5000 ft. as the lower limit of the Temperate Flora, because both on Fernando Po and the Cameroons Mountains the temperate forms preponderate largely at that elevation. In these mountains, however, as in all other tropical ones, on the one hand tropical genera and species ascend to this and to much greater elevations, and on the other some temperate forms descend considerably lower, than their respective temperatures would lead us to expect. This is partly owing to the very varied conditions of exposure, humidity, and temperature which may be found at the same elevation in a mountain-region traversed by gorges and ridges, and still more to the equable annual temperature favouring both the ascent of the tropical forms and the descent of the temperate. Thus we have—

1. Plants of purely tropical forms, ascending up to and above 5000 ft., but whose normal limit is below it. The most remarkable cases are—

| | | feet. | | | feet. |
|---|---|---|---|---|---|
| Stephania | to | 7,000 | Gynura | to | 8,500 |
| Drynaria | „ | 7,000 | Cephalostigma | „ | 7,000 |
| Clausena | „ | 7,500 | Anthocleista | „ | 7,000 |
| Brucea | „ | 7,500 | Alectra | „ | 7,000 |
| Gomphia | „ | 5,000 | Sopubia | „ | 7,000 |
| Schmidelia | „ | 7,500 | Coleus | „ | 7,000 |
| Desmodium | „ | 7,000 | Leucas | „ | 8,000 |
| Shuteria | „ | 7,000 | Achyranthes | „ | 7,000 |
| Dalbergia | „ | 5,000 | Cyathula | „ | 10,000 |
| Kalanchoë | „ | 7,000 | Phyllanthus | „ | 7,000 |
| Mukia | „ | 7,000 | Urera | „ | 5,000 |
| Loranthus | „ | 8,000 | Peperomia | „ | 8,000 |
| Ixora | „ | 5,000 | Bolbophyllum | „ | 6,000 |
| Mikania | „ | 7,000 | Angræcum | „ | 6,000 |
| Microglossa | „ | 7,000 | Polystachya | „ | 6,000 |
| Dichrocephala | „ | 10,700 | Calanthe | „ | 5,000 |
| Blumea | „ | 8,000 | Commelyna | „ | 7,000 |

I have excluded here the annuals, which so often owe their upward extension to local circumstances that do not annually recur; as also all the Panicoid and Andropogonoid grasses. Also many genera which have almost equal claim to rank as temperate and as tropical, as *Pittosporum*, *Impatiens*, *Ilex*, *Vernonia*, *Celsia*, &c. &c.

From a tabulation of these, I find that there are, at elevations above 5000 ft.,—

| | Genera. | Species. |
|---|---|---|
| Truly temperate forms | 80 | 112 |
| Temperate and tropical, or intermediate | 36 | 60 |
| Truly tropical | 46 | 65 |

2. The temperate forms that descend below 5000 ft. are comparatively few. The principal are:—

| | | feet. | | | feet. |
|---|---|---|---|---|---|
| Clematis | to | 4000 | Adenostemma | to | 2000 |
| Hypericum | „ | 4000 | Senecio | „ | 2500 |
| Rubus | „ | 4000 | Leucothoë | „ | 4000 |
| Sanicula | „ | 4000 | Ericinella | „ | 4000 |
| Anthriscus | „ | 4000 | | | |

3. The following species are common to the Himalaya and mountains of Biafra :—

| | feet. |
|---|---|
| Cardamine hirsuta | 7–10,000 |
| —— Africana | 7,500 |
| Cerastium vulgatum | 8,000 |
| Drynaria cordata | 7,000 |
| Oxalis corniculata | 7–8,500 |
| Tillæa pentandra | 8,000 |
| Sanicula Europæa | 4–7,500 |
| Galium Aparine | 7–10,000 |
| —— rotundifolium | 7–12,000 |
| Scabiosa succisa | 10,500 |
| Adenostemma viscosum | 2–1,000 |
| Mikania chenopodiifolia | 4–7,000 |
| Dichrocephala latifolia | 7,000 |
| —— chrysanthemifolia | 7,000 |
| Blumea alata | 7–8,000 |
| Cephalostigma Perrotetii | 7,000 |
| Mæsa Indica | 5–7,000 |
| Cynoglossum micranthum | 7–8,000 |
| Myosotis stricta | 8–10,000 |
| Limosella aquatica | 9–10,000 |
| Sibthorpia Europæa | 7–7,500 |
| Solanum nigrum | 7–11,000 |
| —— Indicum | 6–7,000 |
| Utricularia orbiculata | 5,000 |
| Rumex obtusifolius | 7,000 |
| Polygonum Nepalense | 7,500 |
| Achyranthes argentea | 7,000 |
| Parietaria Mauritanica | 7–8,000 |
| Loranthus Wightii | 7,500 |
| Luzula campestris | 8–10,000 |
| Isolepis capillaris | 8–10,500 |
| Microchloa setacea | 7,000 |
| Deschampsia cæspitosa | 9–12,000 |
| Aira caryophyllea | 7–8,000 |
| Poa nemoralis | 7–10,000 |
| Kœleria cristata | 8–12,000 |
| Vulpia bromoides | 7–10,000 |
| Brachypodium sylvaticum | 7,000 |
| Andropogon distachyus | 7,000 |

In this list twenty-two out of the thirty-nine are European and for the most part British.

4. Genera and species found at elevations above 9000 feet :—

Thalictrum rhynchocarpum.
Cardamine hirsuta.
Silene Biafræ, n. sp.
Arenaria Africana, n. sp.
Sagina Abyssinica.
Hypericum angustifolium.
Adenocarpus Mannii, n. sp.
Trifolium subrotundum.
Rubus apetalus.
Umbilicus pendulinus.
Crassula Mannii, n. sp.
Pimpinella oreophila, n. sp.
Peucedanum Petitianum.
Vignaldia occidentalis, n. sp.
Anthospermum asperuloides, n. sp.
Galium Aparine.
—— rotundifolium.
Scabiosa succisa.
Dichrocephala oblonga.
Helichrysum Mannii, n. sp.
—— fœtidum.
—— chrysocoma.
—— globosum.
Senecio Barterii.
—— Clarenceana, n. sp.
Anisorhamphus hypochæroides ?
Wahlenbergia arguta.
Lobelia acutidens, n. sp.
Leucothoë angustifolia β.
Blæria spicata.
Ericinella Mannii, n. sp.
Sebæa brachyphylla.
Swertia pumila.
—— Clarenceana, n. sp.
Myosotis stricta.

Limosella aquatica.
Veronica Mannii, n. sp.
Bartsia Abyssinica.
Micromeria punctata.
Calamintha Simensis.
Stachys aculeolata, n. sp.
Solanum nigrum.
Cyathula cylindrica.
Thesium tenuissimum, n. sp.
Habenaria præalta.
Trichonema Bulbocodium.
Geissorhiza alpina, n. sp.
Melanthium tenue, n. sp.
Cyanotis Abyssinica.
Luzula campestris.
Isolepis capillaris.
—— schœnoides.
Carex Æthiopica.
Vilfa montana, n. sp.
Deyeuxia Mannii, n. sp.
Deschampsia cæspitosa.
Aira caryophyllea.
—— pictigluma.
Avena lachnantha.
Poa nemoralis.
Kœleria cristata.
Vulpia bromoides.
Festuca Schimperiana.
Andropogon Mannii.

| | | | |
|---|---|---|---|
| Total genera .... | 56 | British .............. | 38 |
| | | Other European ........ | 5 |
| | | Peculiar to Cape ...... | 1 |
| | | —— to Abyssinia .... | 1 |
| | | Chiefly tropical ........ | 4 |

5. The European species found on the mountains of Biafra are the following. I have appended to each any real or apparent facility for aërial or casual transport which it possesses.

Ranunculus pinnatus, 8000 ft. (Achenes with hooked styles.)
Cardamine hirsuta, 7000–10,000 ft. (Seeds very minute.)
Cerastium vulgatum, 8000 ft.? (Ditto.)
Radiola Millegrana, 7000 ft. (Ditto.)
Oxalis corniculata, 7000–8500 ft. (Ditto.)
Umbilicus pendulinus, 7000–10,000 ft. (Ditto.)
Sanicula Europæa, 4000–7500 ft. (Carpels with hooked bristles.)
Galium rotundifolium, 7000–12,000 ft. (Leaves and stems with hooked bristles.)
—— Aparine, 7000–10,000 ft. (Ditto ditto and fruit.)
Scabiosa succisa, 10,500 ft.
Myosotis stricta, 8000–10,000 ft. (Hooked hairs on calyx.)
Limosella aquatica, 9000–10,000 ft. (Aquatic.)
Sibthorpia Europæa, 7000–7500 ft. (Minute seeds.)
Solanum nigrum, 7000–11,000 ft. (Seeds with great powers of vitality.)
Rumex obtusifolius, 7000 ft. (Hooks on fruiting perianth.)
Parietaria Mauritanica, 7000–8000 ft. (Minute seeds.)
Trichonema Bulbocodium, 7000–9000 ft. (Ditto.)
Juncus capitatus, 7000 ft. (Ditto.)
Luzula campestris, 8000–10,000 ft. (Ditto.)
Deschampsia cæspitosa, 9000–12,000 ft. (Ditto.)
Aira caryophyllea, 7000–8000 ft. (Ditto.)

| | |
|---|---|
| Poa nemoralis, 7000–10,000 ft. | (Minute seeds.) |
| Kœleria cristata, 8000–12,000 ft. | (Ditto.) |
| Vulpia bromoides, 7000–10,000 ft. | (Ditto.) |
| Festuca gigantea, 8500 ft. | (Ditto.) |
| Brachypodium sylvaticum, 7000 ft. | (Ditto.) |
| Andropogon distachyus, 7000 ft. | (Ditto.) |

Of these 27, all but the *Radiola*, *Juncus*, and *Festuca* are Abyssinian, and these latter are for the most part West-European forms.

The most remarkable features of the Temperate vegetation of these mountains are—

1. The poverty of the flora.
2. The preponderance of Abyssinian genera and species.
3. The considerable proportion of European plants.
4. The paucity of South-African genera and species.
5. The great rarity of new genera.
6. The absence of St. Helena types.

Upon each of these propositions I have a few general remarks to offer.

1. In the poverty of its flora the Cameroons range, &c. seems to partake of the characteristics of the Abyssinian Alps. We know far too little of the physical geography of either of these districts to hazard many conjectures upon this point, which must to a certain extent be dependent on the arid volcanic nature of the soil and the limited area of the temperate region. Mr. Mann spent many weeks, and at various seasons, in his explorations, and yet 237 flowering plants were all that rewarded his toil. Geological causes have probably had, in the case of the Cameroons Mountains, much to do with the dearth of species, some parts of the range even now presenting evidence of subterranean heat.

2. The preponderance of Abyssinian forms is proved by almost all of the genera and half the species being natives of Abyssinia, and by many other species being very closely related to, or obvious representatives of, plants of that country. There are, further, several of the genera and many of the species peculiar to Abyssinia and the peaks of Biafra.

3. The number of European genera amounts to 43, and species to 27, by far the greater part of which are British; and a few of them, as *Radiola Millegrana*, have not been found previously anywhere in the African continent*. Very few of them extend into South Africa. The greater part are Abyssinian; the remarkable exceptions being *Radiola*, *Scabiosa succisa*, *Luzula campestris*, and

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* Since this Paper was read, I have been informed by Mr. Munby that he has found *Radiola Millegrana* in one spot in Algeria.

*Festuca gigantea*, all of which, however, may have been hitherto overlooked in Abyssinia.

Considering the total isolation of these tropical African mountains from the European regions by hot, low deserts, the existence of these plants in common is most singular, and explicable under two hypotheses: 1st, Mr. Darwin's theory, which assumes that during the glacial epoch the plants of the northern zones were driven southwards into the tropics, and on the return of warmth they both retreated northwards and ascended the intertropical mountains; and 2nd, transport by aërial currents and birds—in favour of which is to be urged that, of the whole, six present structural adaptations for clinging to the plumage of birds, and all the rest have small or very minute seeds, likely to be transported in mud on the feet of birds. *Solanum nigrum* has rather larger seeds, but with remarkable power of retaining their vitality, and, further, is found in North Africa and many intermediate countries, as are several of the others.

4. The paucity of South-African types was alluded to in discussing the 76 species of the Fernando Po mountain. The great accession of species from the Cameroons has added but few Cape forms; the principal are, *Anthospermum*, *Anisorhamphus* (perhaps referable to *Hieracium*), a species of *Ilex*, *Lasiosiphon*, *Peddiea*, *Geissorhiza*, *Hypoxis*, and a few others.

5. Only one new genus has been found, *Ardisiandra* (see Plate I.)—a very well marked new form of Primulaceæ, not indicating an affinity with any other flora.

6. Of the peculiar genera and species of St. Helena not one has been found; and what genera are common to that island and these mountains are also natives of the Cape region, and far more abundant there.

## *Florula of the Peaks of Biafra at and above 5000 feet elevation.*

### 1. RANUNCULACEÆ.

1. CLEMATIS SIMENSIS, *Fresen.* (*ante*, vi. 4).

*Hab.* Fernando Po and Cameroons Mountains, alt. 4000–8000 feet. (Fl. and frt. Dec.–Jan.)

Fruiting specimens are identical with Abyssinian. The Cameroons Mountains' individuals have the flowers as large as the Abyssinian.

2. THALICTRUM RHYNCHOCARPUM, *A. Rich* (*ante*, vi. 4).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. and frt. Nov.)

3. **Ranunculus pinnatus**, *Poir.*, var. *extensa*. Carpellis lævibus (*ante*, vi. 5).

*Hab.* Fernando Po, alt. 8000 feet. (Fl. Dec.)

### 2. Menispermaceæ.

1. **Stephania hernandifolia**, *Wall.* (*ante*, vi. 5).

*Hab.* Fernando Po, alt. 3000–5000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. and frt. Dec.)

### 3. Cruciferæ.

1. **Cardamine hirsuta**, *L.*, var. *Simensis*. C. Simensis, *Hochst.*

*Hab.* Fernando Po, alt. 7500–8500 feet. Cameroons Mountains, alt. 8000–10,000 feet. (Fl. Nov.)

2. **Cardamine Africana**, *Thunb.*, var. *pubescens*.

*Hab.* Fernando Po, alt. 7500 feet.

### 4. Violarieæ.

1. **Viola Abyssinica**, *Steud.*, var. *impunctata* (*ante*, vi. 5).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Jan.)

### 5. Pittosporeæ.

1. **Pittosporum Mannii**, *H.f.* (*ante*, vi. 5).

*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 4000–7500 feet. (Fl. Dec.; frt. Jan.)

The Cameroons specimens contain excellent fruit, from which I learn that the small capsules alluded to in the Fernando Po plant were imperfectly developed; those now sent are very similar to *P. Senacia* of Mauritius, from which, however, as before observed, the species differs widely in the inflorescence and small flowers.

### 6. Polygaleæ.

1. **Polygala tenuicaulis**, *H.f.*, n. sp. Annua, patentim pilosa, caule gracili simpliciusculo elongato, foliis anguste lineari-lanceolatis, racemis multifloris secundis, bracteis bracteolisque minutis, floribus breviter pedicellatis, sepalis pilosis exterioribus late oblongis alis late obovatis triente brevioribus, carinæ crista brevi bilamellata, capsula obcordata emarginata pilosa.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov. and Dec.)

*Herba* spithamæa ad pedalem, ubique pilis patentibus tomentella v. hispidula, caule gracili teretiusculo debili superne sæpius diviso. *Folia* ½–1″ longa, marginibus siccitate recurvis. *Racemi* 2–3″ long. *Flores* rubicundi (siccitate flavo-virescentes), nutantes, ⅕″ longi. *Alæ* venosæ. *Carinæ* crista inclusa. *Capsula* membranacea, inclusa.

### 7. CARYOPHYLLEÆ.

1. SILENE BIAFRÆ, *H.f.*, n. sp. Erecta, pubescenti-tomentosa, foliis anguste linearibus, floribus suberectis, calyce anguste oblongo-campanulato atro-pubescente, lobis anguste oblongis subacutis, costis crassis atris, petalis calyce paulo longioribus pubescentibus, lamina parva ad medium 2-loba carnosa basi appendicibus 2 carnosis coronata, thecaphoro capsula triente breviore.

*Hab.* Cameroons Mountains, alt. 8000–10,000 feet. (Fl. Nov.)

*Herba* 1–3-pedalis, parce ramosa, ramis teretibus. *Folia* pollicaria et ultra, anguste linearia. *Racemi* 4–8-flori. *Flores* nutantes v. erecti, breviter pedicellati, ½ unc. longi.

Very nearly allied to the North-African and Abyssinian *S. bipartita*, Desf. (to which the Cape *S. Burchellii* is too nearly allied), but differing in its great size, the less contracted base of the calyx, small fleshy lamina of the petals, and the corona reduced to two prominent fleshy lobes. It is probable that these are all states of one species, of which the present, from the most tropical and humid locality, has much more highly developed vegetative organs and correspondingly reduced reproductive ones. I cannot determine whether it is annual or perennial.

2. CERASTIUM VULGATUM, *L.*, var. *glomeratum*, Thuil. C. viscosum, *Fries.*

*Hab.* Cameroons Mountains (no elevation given).

The leaves are more uniformly acute than in the common European states. It is also an Abyssinian plant, *C. Simense*, Hochst., in no way differing from the European form.

3. STELLARIA MANNII, *H.f.*, n. sp. Caule procumbente diffuse ramoso tenui glaberrimo, apicibus ramorum et inflorescentia glanduloso-pilosis, foliis petiolatis ovatis acutissimis, floribus laxe paniculatis, sepalis ovato-lanceolatis acuminatis, petalis sepala subæquantibus ad medium 2-fidis, stylis 3, capsula 4-valvi 1-sperma.

*Hab.* Cameroons Mountains, alt. 7000 feet.

*Caules* 1–2-pedales, flaccidi, ramis adscendentibus. *Folia* longe petiolata, ⅔–1 unc. longa, læte viridia, tenuiter membranacea, margine subcrispato, petiolo ¼–¾ unc. longo. *Flores* ad apices ramorum laxe paniculati, graciliter pedicellati, ⅓ unc. lati, bracteis lanceolatis acuminatis. *Sepala* viridia, herbacea, carinata. *Petala* tenerrima, lobis falcatis apicibus conniventibus. *Ovarium* parvulum, 5–6-ovulatum. *Capsula* parvula, glaberrima. *Semen* (morbidum ?) magnum, testa papilloso-granulosa.

Very closely allied to the Cingalese *S. drymarioides*, Thw., and Himalayan *S. monosperma*, Ham., but differing from both in the foliage and larger flowers.

4. ARENARIA AFRICANA, *H.f.*, n. sp. Tota (superne præcipue) glanduloso-pilosula v. pubescens, caulibus gracilibus prostratis, foliis distantibus sessilibus lanceolatis acutissimis membranaceis, floribus ad apices ramorum paucis laxe paniculatis, sepalis oblongis subacutis anguste marginatis, petalis angustis retusis v. breviter 2-lobis, stylis 5, capsula oblonga 5-valvi, seminibus aurantiacis granulatis.

*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec.)

*Caules* ¼–1-pedales, laxe ramosi, debiles, fragiles, internodiis 1–2 unc. longis. *Folia* patentia, plana, pollicaria, basi obtusa, utrinque glanduloso-pilosa. *Panicula* pauciflora, pedicellis ¼–½ unc. longis. *Flores* ⅓ unc. diam. *Sepala* viridia, planiuscula. *Petala* sepalis longiora, alba, tenuiter membranacea, sensim apicem versus latiora, apice rotundato retuso v. 2-fido. *Stamina* 10, filamentis tenuissimis. *Ovarium* lineari-oblongum. *Capsula* sepalis paulo longiora. *Semina* ad 10–12, compressa, opaca, cotyledonibus incumbentibus.

A flaccid slender species, much resembling some very weak shoots of the North-African *A. procumbens*; but the flowers are white, the leaves are very different, the cotyledons accumbent, and, as far as I can make out, the capsule is only 5-valved. I know of no very nearly allied species. The petals are sometimes as much bifid as in many Stellarias; they vary much, sometimes even in the same flower.

5. SAGINA ABYSSINICA, *Hochst.* (*ante*, vi. 6).

*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 9000–11,000 feet. (Fl. Nov.–Jan.)

Plant sometimes forming dense hard tufts with woody roots.

6. DRYMARIA CORDATA, *Willd.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

## 8. HYPERICINEÆ.

1. HYPERICUM ANGUSTIFOLIUM, *Lamk.* (*ante*, vi. 6).

*Hab.* Fernando Po, alt. 7000–10,000 feet. Cameroons Mountains, alt. 4000–8000 feet. (Fl. Dec.)

The leaves of Cameroons specimens are as narrow as of Abyssinian, and as well as the calyx are copiously glandular, but have few black dots.

## 9. LINEÆ.

1. RADIOLA MILLEGRANA, *L.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Absolutely identical in every particular with the European plant, which ranges from Scandinavia to Spain and from Madeira to Southern Russia, but has not hitherto been found in North Africa*.

### 10. GERANIACEÆ.

1. **GERANIUM EMIRNENSE**, *Hils. & Boj. MSS. in Hb. Hook.*
*Hab.* Fernando Po, alt. 8500 feet.

2. **GERANIUM SIMENSE**, *Hochst.* (*ante*, vi. 6).
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.-Jan.)

The same as Hochstetter's plant, except in the sepals being rather more gradually acuminated and the stipules rather narrower. It differs from the Fernando Po and Madagascar *G. Emirnense*, Hils. & Boj., with which it is confounded in the Fernando Po florula, in wanting the spreading hairs. In Abyssinia it inhabits the middle region of Mount Silke.

3. **GERANIUM FAVOSUM**, *Hochst.*
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)—Herbacea, 4-pedalis.

Except in the rather smaller size of all its parts, and the lobing of the leaf hardly being carried below the middle, this is identical with the very remarkable Abyssinian species of Hochstetter. It is readily distinguished by the slender habit, copious spreading glandular hairs in all its parts, membranous foliage with acutely laciniate lobes, very short peduncles—often so short that the pedicels appear in pairs in the axils of the leaves, and the rugose carpels. In Abyssinia it is found at 5500 feet elevation, in the province of Agow.

4. **OXALIS CORNICULATA**, *L.* (*ante*, vi. 8).
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

### IMPATIENS.

I have here described all the species of this beautiful genus which have been discovered by Mr. Mann in the Islands of Biafra, Cameroons Mountains, and Sierra del Crystal.

1. **VERTICILLATÆ.** *Folia* verticillata v. opposita. *Flores* subumbellati v. in racemos longe pedunculatos breviter pedicellati.

1. **IMPATIENS SAKERIANA**, *H.f.*, n. sp. Caule erecto, foliis verticillatis

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* See footnote at p. 181.

graciliter petiolatis oblongo-lanceolatis acuminatis cuspidato-serratis, pedunculis folio longioribus, floribus breviter racemosis, sepalis late ovatis, vexillo galeato, labello infundibuliformi in calcar robustum apice inflatum contracto, alis parvis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–Jan.)

Species pulcherrima, elata, 8-pedalis, ramosa?, inferne glabra, apicibus ramorum petiolis pedunculis basi foliisque junioribus subvillosis. *Folia* 1–4 unc. longa, in verticillo 3–6, petiolis ½–3 unc. long., patentia, membranacea, glaberrima v. pilosula, crenato-serrata, crenis apice v. prope apicem setosis. *Pedunculi* validi, valde elongati, rigidi, 4–10-flori. *Bracteæ* ovatæ, acuminatæ, herbaceæ, persistentes. *Pedicelli* ½–1 unc. longi. *Flores* coccinei? *Sepala* bracteis similia, viridia, herbacea. *Vexillum* tumidum, valde concavum, obtusum, dorso apiculatum, lateribus productis. *Labellum* cum calcari ¾ unc. long., calcari in apicem pyriformem 2-lobum tumente. *Alæ* lineares, vexillo vix longiores, porrectæ, flavo et purpureo ut videtur coloratæ. *Capsula* ⅔ unc. longa, ovalis, medio turgida, utrinque attenuata.

Named in compliment to the Rev. Mr. Saker, Mr. Mann's companion in his ascent of the Cameroons Mountains, and to whom he is much indebted for the success of his enterprising journey.

2. UMBELLATÆ. *Folia* alterna. *Flores* ad apicem pedunculi elongati, subumbellati.

2. IMPATIENS FILICORNU, *H. f.* (*ante*, vi. 6).

*Hab.* Fernando Po, alt. 4000–5000 feet. Sierra del Crystal. (Fl. Dec.)

3. IMPATIENS MACROPTERA, *H. f.*, n. sp. Glaberrima, caule crasso erecto nodoso, foliis apicem versus caulis alternis petiolatis ovatis acuminatis grosse crenatis inter crenas setiferis, pedunculis axillaribus elongatis erectis 2–4-floris, bracteis sepalisque ovatis acutis, pedicellis breviusculis, floribus magnis, vexillo parvo orbiculato purpureo, labello late oblique conico, calcari brevi incurvo, alis maximis pendulis oblongis obtusis.

*Hab.* Fernando Po, alt. 4500 feet. (Fl. April.)

*Herba* 2–4-pedalis. *Caulis* nodosus. *Folia* (cum petiolo glaberrimo) 3–4″ longa, superne sub lente fasciculis subcutaneis raphidum notata. *Pedunculi* folia superantes. *Bracteæ* et *sepala* consimilia, ⅕″ longa. *Pedicelli* 1″ longi. *Flores* 2–2½″ longi, albi et virescentes (*ex Mannio*). *Vexillum* ut videtur ex sicco violaceum.

4. IMPATIENS PALPEBRATA, *H. f.*, n. sp. Parvula, pilosula, caule simplici paucifoliato, foliis graciliter petiolatis anguste oblongo-ovatis cordatis grosse crenatis crenis infimis longissime ciliolatis, scapo longissimo tenui apice florifero, bracteis minutis, pedunculis breviusculis, sepalis majusculis, vexillo breviusculo, alis elongatis stipitatis,

labello brevi in calcar crassum basi abrupte incurvum acutum repente contracto.

*Hab.* Sierra del Crystal. (Fl. July.)

Spithamæa. *Folia* ¾–1 unc. longa, membranacea, profunde crenato-lobulata, ciliis basi rigidis fere ¼ unc. longis; petiolo laminæ subæquilongo. *Scapus* 3 unc. longus, gracilis, apice 3–5-florus, pedicellis ¼ unc. longis. *Flores* ½ unc. diam. *Vexillum* ⅙ unc. latum, sepalis æquilongum. *Alæ* divaricatæ, ⅓ unc. longæ, dimidiato-oblongæ, purpureæ. *Labellum* ¼ unc. longum, ore oblongo, acuto, purpureo et viridi striato.

3. Unifloræ. *Folia* alterna. *Pedunculi* axillares, sæpissime solitarii v. bini, uniflores.

5. Impatiens Mannii, *H. f.* (*ante*, vi. 7).

*Hab.* Fernando Po, alt. 4000 feet. Cameroons Mountains, alt. 2500–3000 feet. (Fl. April–Dec.)

In exemplaribus e mont. Cameroons, nervi foliorum subtus pedunculique pubescentes evadunt, et vexillum latius.

6. Impatiens bicolor, *H. f.* (*ante*, vi. 7), *Hook. Bot. Mag.* t. 5366.

*Hab.* Fernando Po, alt. 4000 feet. Cameroons Mountains, alt. 3500 feet. (Fl. Dec.–Feb.)

7. Impatiens Burtoni, *H. f.*, n. sp. Caule gracili erecto superne foliisque junioribus pilis mollibus subvilloso, foliis alternis graciliter petiolatis ovato- v. oblongo-lanceolatis acuminatis crenatis membranaceis utrinque sparse pilosulis, pedunculis solitariis axillaribus 1-floris gracilibus, sepalis lineari-lanceolatis acuminatis, vexillo bilobo dorso carinato piloso cornuto, labello late infundibuliformi, calcari tenui lente curvo, alis amplis.

*Hab.* Cameroons Mountains, alt. 2500–3000 feet. (Fl. Dec., Jan.)

*Herba* 2–3-pedalis. *Caulis* inferne glaber, siccitate sulcatus. *Folia* 3–4 unc. long., in petiolum attenuata, sinibus crenarum setulosis. *Pedunculi* petiolis longiores, erecti v. patentes. *Flores* flavi?, 1 unc. longi. *Vexillum* alis dimidio minus, late quadratum. *Calcar* vexillo vix longius, lente curvum. *Alæ* rhombeo-triangulares, patentes, angulis rotundatis. *Capsula* late elliptica, glaberrima.

4. Laterifloræ. *Folia* alterna. *Pedunculi* axillares, solitarii, sæpissime 2–4-flores.

8. Impatiens hians, *H. f.* (*ante*, vi. 7).

*Hab.* Fernando Po, alt. 2000 feet.

9. Impatiens buccinalis, *H. f.*, n. sp. Glaberrima, caule ramoso, ramis geniculatim flexuosis apices versus foliatis, foliis petiolatis oblongo-lanceolatis acuminatis crenatis inter crenas setiferis, petiolis setis crassis glanduliferis sparsis, racemis brevibus 2–4-floris, bracteis late ovatis mucronatis, pedunculo brevi, pedicellis gracilibus flore

brevioribus, sepalis late ovatis cuspidatis, vexillo cucullato dorso late alato, labello crasso elongato cylindrico in calcar crassum circinatum intus gibbum contracto, alis parvis inclusis.

*Hab.* St. Thomas's Island, alt. 4000 feet.

*Herba* frutescens 12–15-pedalis (*G. Mann*), ramis ad axillas foliorum glandula depressa orbiculari auctis. *Folia* 4–6" long., membranacea, nervis arcuatis, petiolo setis crassis glanduligeris sparsis. *Flores* 2" longi, 1½" diametr. (ut videtur ex sicco rubri). *Vexillum* profunde concavum et dorso late alatum. *Labellum* ore acuminato, crassum, curvum, ad apicem in calcar circinatum abrupte attenuatum, latere incurvo ad basin calcaris abrupte gibbo inflato; calcari crassi, brevi, apice obtuso. *Alæ* parvæ, 2-lobæ, obtusæ, vexillo æquilongæ, os labelli non excedentes.

10. IMPATIENS MACKEYANA, *H. f.*, n. sp. Elata, robusta, glaberrima; caule crasso, foliis ad apicem caulis confertis alternis petiolatis elongato-lanceolatis setoso-serratis, pedunculis axillaribus brevibus 2–3-floris, floribus maximis, vexillo amplo latissime ovato, alis stipitatis amplissimis, labello brevi late conico v. scaphæformi in calcar tenue inflexum repente contracto.

*Hab.* Sierra del Crystal, on rocks. (Fl. July.)

Species omnium fere speciosissima. *Caulis* 1–2-pedalis, succulentus. *Folia* 4–10 unc. longa, petiolis 1–3 unc. longis, sparse glandulosis v. setosis. *Pedunculi* cum pedicellis 1–3 unc. longi; bracteis minutis. *Flores* læte purpurei, 2–3 unc. diametr. *Sepala* ¼–⅓ unc. longa, oblique oblonga, acuminata. *Vexillum* 1 unc. latum, obtusum, membranaceum, multo latius quam longum. *Alæ* 2 unc. longæ, patentes, 2-lobæ, lobo inferiore laterali subrotundato quam terminalis obovatus multo minore. *Labellum* breve, ore oblongo 1 unc. diametr. longiore; calcari ⅓ unc. longo. *Capsula* ⅓ unc. longa, oblique oblonga, utrinque attenuata. *Semina* perplurima, minuta, obovoidea, rufa, papillosa.

## 11. RUTACEÆ.

### Trib. AURANTIACEÆ.

1. CLAUSENA INÆQUALIS, *Benth. in Fl. Nigrit.* 257.

*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec.–Feb.) (Tree 10 feet).

Professor Oliver, who has kindly examined these specimens, finds no difference, beyond the more luxuriant habit, between them and others from South Africa, where it abounds from Uitenhage to Macalisburg. He further identifies it with *C. anisata* of Cape Coast, and considers it scarcely distinguishable from *C. Willdenovii* of India, except by the collateral insertion of the ovules.

### 12. SIMARUBEÆ.

1. BRUCEA ANTIDYSENTERICA, *Miller*.

*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec.–Feb.)

Mann's plant seems identical with the Abyssinian. It grows 20 feet high.

### 13. OCHNACEÆ.

1. GOMPHIA MICRANTHA, *H. f.* (*ante*, vi. 8).

*Hab.* Fernando Po, alt. 5000 feet. (Fl. Nov.)

### 14. ILICINEÆ.

1. ILEX CAPENSIS, *Sond. & Harv. Fl. Cap.* i. 473.

*Hab.* Cameroons Mountains, alt. 4000–7500 feet. (Fl. Feb.)

Apparently a very common South-African plant, found from the vicinity of Cape Town to Macalisburg. It attains 40 feet high on the Cameroons.

### 15. AMPELIDEÆ.

1. VITIS (CISSUS) CYPHOPETALA, *Fres.*; *A. Rich. Fl. Abyss.* i. 110.
Var. *occidentalis*, foliolis glabratis acutius serratis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

Very near indeed to the Abyssinian plant, but differing in the rather narrower, more acuminate leaflets with sharper serratures, and in being everywhere less pubescent; the structure of the remarkable flowers is identical. The leaves show a tendency to become digitate.

### 16. SAPINDACEÆ.

1. SCHMIDELIA ABYSSINICA, *Hochst. in Pl. Schimp.* S. Africana, *DC. ex A. Rich., Flor. Abyss.* i. 102, sed vix.

*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec.)

The ripe carpels of the Cameroons specimens are rather larger than those of the Abyssinian (*S. Abyssinica*, Hochst.), and more distinctly pedicellate. Our specimens are from a tree 30–40 feet high. Schimper describes it as "arbor altissima," and says it grows in the mountain-region of Semajata. A. Richard unites the Abyssinian plant with the Oware one of Palisot; but they differ so much in the size of the flowers, that they seem scarcely the same specifically.

### 17. LEGUMINOSÆ.

1. ADENOCARPUS MANNII, *H. f.* Cytisus Mannii (*ante*, vi. 8).

*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 7000–12,000 feet. (Fl. Dec.)

The flowers of the Cameroons Mountains' specimens are con-

siderably larger than the Fernando Po ones, and the pods prove it to be a true *Adenocarpus*.

2. TRIFOLIUM SUBROTUNDUM, *Steud. & Hochst.*; *var.* stipulis majoribus (*ante*, vi. 8).
*Hab.* Fernando Po, alt. 9000 feet. (Fl. Dec.)

3. TRIFOLIUM SIMENSE, *Fresen.* (*ante*, vi. 9).
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Nov., Dec.)

4. INDIGOFERA ATRICEPS, *Hook.*, n. sp. Fruticulus gracilis, hispido-setulosus, foliis imparipinnatis, foliolis 9–13 obovatis v. obovato-oblongis apiculatis utrinque petiolisque hispidulis, pedunculis axillaribus foliis longioribus racemisque brevibus atro-pilosulis, calycis tubo brevi turbinato lobis longe subulatis, ovario 5–8-spermo, legumine hispido-piloso stylo filiformi persistente terminato.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–Jan.)
*Fruticulus* ramosus, 2–3-pedalis, ramis teretiusculis, partibus novellis setis patentibus deciduis glandulosis sparsis, ramulis ultimis pedunculis calycibusque atris. *Folia* ¾–1½ unc. longa, petiolo gracili; foliola petiolulata, plana, enervia, ⅓–½″ longa; stipulæ filiformes. *Flores* ¼ unc. longi, purpurei, breviter pedicellati, conferti, subsecundi; bracteolæ subulatæ. *Calycis* lobi stamina æquantes. *Vexillum* late oblongum, apice rotundatum, reflexum, dorso hispido-pilosum. *Alæ* spathulatæ, obtusæ, carinam æquantes, apices versus extus hispidulæ. *Antheræ* longe mucronatæ. *Legumen* teretiusculum, ⅓ unc. long., setulis atris bifurcatis hispidulum, pilisque pallidis glanduliferis patentibus sparsis deciduis onustum. *Ovarium* pilosum, septis spuriis locellatum, 6–8-spermum. *Semina* parva, immatura.

5. DESMODIUM STRANGULATUM, *Wight & Arn.*
*Hab.* Cameroons Mountains, alt. 2000–7000 feet. (Fl. Jan.)

A variety with obtuse leaves (so far as I can judge without ripe fruit) of the common tropical Indian and African weed, which varies with leaflets acuminate and obtuse.

6. SHUTERIA AFRICANA, *H.f.*, n. sp. Molliter retrorsum sericeo-pilosa, stipulis bracteisque lineari-oblongis scariosis multistriatis, foliolis late ovato-oblongis ovatisve longe apiculatis membranaceis superne pilosis subtus sericeo-pilosis, racemis elongatis, floribus graciliter pedicellatis, calycis tubo cylindraceo-campanulato lobis subulatis duplo longiore, leguminibus lineari-ensiformibus undulatis compressissimis marginatis.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)
*Caulis* gracilis, volubilis, 10–12-pedalis. *Petioli* graciles, 2 unc. longi. *Foliola* 2 unc. longa, lateralia basi stipellis filiformibus aucta. *Stipulæ*

⅓ unc. longæ. *Racemi* 3–4 unc. longi, multiflori; bracteæ ¼–⅓ unc., pedicellis longiores. *Flores* ½ unc. long. *Calyx* ebracteolatus, parce pilosus. *Corolla* purpurea. *Vexillum* obovatum, anguste biauriculatum. *Stamen* vexillare, liberum. *Stigma* capitatum. *Legumen* subsericeum, ½–1 unc. longum, ⅛ unc. latum, utrinque oblique acutatum, apice rostratum, 2–4-spermun, intus continuum. *Semina* reniformia, marmorata, ⅛ unc. lata.

This is identical with an Abyssinian species collected by Dr. Roth near Ankobar.

7. DALBERGIA, sp.

*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Dec.)

A tropical, glabrous, and apparently new species, of which I have no fruit. The leaflets are 3–4-jugate, petiolulate, lanceolate, with attenuate retuse apices, coriaceous. Flowers on short, branched, nearly glabrous panicles.

## 18. ROSACEÆ.

1. RUBUS APETALUS, *Poir.* (*ante*, vi. 9).

*Hab.* Fernando Po, alt. 7000 feet. Cameroons Mountains, alt. 4000–9000 feet. (Fl. Nov.)

Some of the Cameroons Mountains' specimens are apetalous, like the East African; and Mr. Mann observes that the fruit is eatable.

2. ALCHEMILLA TENUICAULIS, *H. f.*, n. sp. Parvula, laxe molliter patentim villosa, caulibus elongatis prostratis, foliis orbiculari-reniformibus 5–7-lobis, lobis obtusis crenulato-serratis, foliis floralibus cuneatis 3-lobis, calycis lobis brevibus ovatis, acheniis 2–4 glabris.

*Hab.* Fernando Po, alt. 7500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Caules* 6–12 unc. longi, tenues. *Folia* radicalia conferta, ½–¾ unc. lata, utrinque sericeo-pilosa, fere ad tertiam partem 5–7-loba. *Stipulæ* membranaceæ v. herbaceæ, profunde dentatæ. *Flores* in axillis foliorum floralium, laxe spicatæ, parvæ, sessiles. *Calycis* tubus glabriusculus, lobis parvis ovatis acutis. *Stamina* imperfecta 3 tantum visa. *Achenia* matura 2–4, stipitata, minuta, glabra.

Very similar in many respects to the *A. Capensis*, Th., but smaller in all its parts, with smaller calyx-lobes, and several much smaller achenia. The Abyssinian *A. pedata*, Hochst., has deeper-cleft leaves.

3. PYGEUM AFRICANUM, *H. f.*, n. sp. Glaberrimum, foliis longe petiolatis elliptico-oblongis obtuse acuminatis et serratis, racemis multifloris, calycis 5-lobi tubo lato intus piloso, petalis parvis fimbriatis.

*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec., Jan.)

*Arbor* 30–40-pedalis. *Folia* 4 unc. longa, submembranacea, læte viridia, glaberrima, eglandulosa, reticulatim venosa, petiolo gracili ½ unc. longo.

*Stipulæ* parvæ, deciduæ. *Racemi* pollicares et ultra, 12–20-flori, patentes. *Pedicelli* patentes v. decurvi, ¼ unc. longi, ebracteati. *Calycis* tubus hemisphærico-campanulatus, lobis brevibus latis obtusis. *Petala* parva, alba. *Stamina* 20–30, filamentis brevibus subulatis. *Antheræ* oblongæ. *Ovarium* oblique ovoideum, in stylum crassum brevem subangustatum, stigmate magno, obliquo.

Apparently identical with a species gathered in tropical Eastern Africa by Dr. Kirk (Livingstone's Expedition), at an elevation of 3000 feet, at the foot of Mount Tshiradzuri and near Mungazi, of which I have fruit only. The latter is a much depressed sphere, near ½ inch in longest diameter, coriaceous and 1-seeded. The leaves are rather more deeply toothed in Mann's plant; but that is a most variable character amongst its allies.

## 19. CRASSULACEÆ.

1. TILLÆA ALSINOIDES, *H.f.*, n. sp. Herba foliosa, ramosa, glaberrima, annua?; foliis breviter petiolatis ovato-oblongis subacutis integerrimis subenerviis, petiolis basi in vaginam brevem ciliatam connatis, floribus axillaribus solitariis graciliter pedicellatis, calycis laciniis planiusculis acutis petala consimilia subæquantibus, squamulis hypogynis 0, capsula polysperma.

*Hab.* Fernando Po, alt. 7500 feet.

*Herba* habitu *Alsines mediæ*. *Caules* graciles, ramosi, ad nodos radicantes. *Folia* ⅓ unc. longa, obscure 3-nervia, crassiuscula. *Pedunculi* foliis longiores v. breviores. *Flores* albi, ⅓ unc. diametr. *Capsulæ* membranaceæ, sepalis æquilongæ. *Semina* oblonga, pallida.

This species has been gathered near Ankobar in Abyssinia by Dr. Roth.

2. TILLÆA PHARNACEOIDES, *Hochst. Pl. Abyss.* i. 104. Combesia Abyssinica, *A. Rich. Fl. Abyss.* i. 307. Disporocarpa pharnaceoides, *C. A. Mey.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

Also an Abyssinian and N.W. Indian plant.

3. TILLÆA PENTANDRA, *Royle.*

*Hab.* Cameroons Mountains, alt. 8000 feet. (Fl. Nov.)

A Himalayan and Nilgherrie Mountains' plant; also found by Roth and Parkyns in Abyssinia.

4. UMBILICUS PENDULINUS, *DC.*

*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Nov.)

Apparently the same as the European plant, but rather more fleshy in habit, of a deeper green colour, and with the bracts often but not always, foliaceous, and varying greatly in size and in form from linear to oblong-spathulate. A. Richard's Abyssinian *U. botryoides* is the same plant. The range of *U. pendulinus* is from Britain to Mogadore in N.W. Africa, and from Madeira and the Canary Islands, throughout the Mediterranean Sea to the Greek Archipelago, and Abyssinia.

5. CRASSULA (EUCRASSULA, *Harv. Fl. Cap.*) MANNII, *H.f.* Herbacea, caule brevi crasso robusto simplici basi glabro superne minute papilloso, foliis oblongo- v. cordato- v. lineari-lanceolatis in vaginam elongatam connatis ovato-lanceolatis margine papillis fimbrillatis, cymis ramosissimis densifloris, floribus parvis glaberrimis breviter pedicellatis, sepalis oblongo-ovatis obtusis, petalis oblongis obtusis eglandulosis basi subconnatis sepalis vix duplo longioribus, glandulis cuneato-quadratis.

*Hab.* Cameroons Mountains, alt. 6000–10,000 feet. (Fl. Dec.)

*Herba* 6–18 unc. alta, robusta, simplex, caule crassitie pennæ olorinæ et ultra, teres, foliosa. *Folia* valde varia, 1–4 unc. longa, interdum late ovato-subcordata, glaberrima, margine tenuiter fimbrillato excepto. *Cymæ* dense congestæ, in corymbum amplum compositum 3 unc. latum dispositæ. *Bracteæ* foliaceæ, sensim minores. *Flores* sub ⅛ unc. diam.

Very nearly allied to *C. Abyssinica*, A. Richard; but the papillæ on the upper part of the plant are much shorter, the leaves less acute, the flowers considerably smaller, and both sepals and petals shorter, broader, and blunter.

6. KALANCHOË ÆGYPTIACA, *DC.* Glaberrima, foliis obovato-oblongis apice rotundatis in petiolum attenuatis grosse crenatis, paniculis amplis umbellatim cymosis multifloris, floribus ⅛ unc. longis, sepalis lanceolatis acuminatis, corolla calyce triplo longiore tubo 4-gono urceolato ore angusto lobis oblongis acuminatis.

*Hab.* Cameroons Mountains, alt. 3000–7000 feet. (Fl. Dec., Jan.)

*Herba* elata, 4–6-pedalis, glaberrima. *Caulis* teres, superne trichotome ramosus, floribundus. *Folia* 3–4 unc. longa, in petiolum 1–1½ unc. long. attenuata, grosse crenata, siccitate venosa. *Cymæ* valde ramosæ, subumbellatæ, pedicellis gracilibus, bracteis bracteolisque anguste lanceolatis v. setaceis. *Flores* ut videtur aurantiaci. *Stamina* brevia. *Glandulæ* hypogynæ lineares. *Folliculi* membranacei, longe attenuati. *Semina* minuta, oblonga, flava.

So very nearly allied to *K. Ægyptiaca*, DC. Pl., Grasses, 64, that I hesitate to distinguish it specifically; but the leaves are coarsely crenate, and not toothed as represented in De Candolle's figure. That author, however, describes the leaves as crenate or sometimes entire. I have seen no authentic specimens of *K. Ægyptiaca*, which Forskahl describes (under the name of *Cotyle-*

*don deficiens*) as a native of Mount Melhan in Arabia (lat. 14° 40′ N., long. 44° E.), and adds that the plant is cultivated in Egypt. De Candolle erroneously considers Mount Melhan to be in Egypt.

Hochstetter and Steudel refer an Abyssinian tomentose *Kalanchoë* (*Schimperiana*, A. Richard, Fl. Abyss. i. 310) to Forskahl's *Cotyledon deficiens*; but no doubt erroneously, as A. Richard suspects.

From the Botanical Magazine figure (tab. 1436, sub *Cotyledone*) of *K. crenata*, Haw. Synops. 109, Mann's plant differs solely in the absence of any hairs, and the apparently darker-coloured flowers, the leaves being identical. *K. crenata* is a native of Western tropical Africa. De Candolle does not describe *K. crenata* as at all hairy.

## 20. Cucurbitaceæ.

1. **Mukia**, sp.?

*Hab.* Fernando Po, alt. ? Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.) (Male fl. only.)

A similar and probably identical species is found in Abyssinia; it resembles a good deal the common Indian *M. scabrella.*

2. **Bryonia**, sp.

*Hab.* Cameroons Mountains.

A very small-flowered species, not unlike *B. Americana* in habit.

## 21. Umbelliferæ.

1. **Hydrocotyle monticola**, *H.f.*, n. sp. Pusilla, glaberrima, caule filiformi elongato, foliis breviuscule petiolatis peltatis orbiculatis basi bilobis 6–9-lobulatis, lobulis crenulatis, pedunculis brevissimis 2–4-floris, mericarpiis 1-costatis dorso acutis, stylis breviusculis.

*Hab.* Cameroons Mountains, alt. 8500 feet.

*Caules* tenuissimi, intertexti, 2–4 unc. longi. *Folia* $\frac{1}{8}$–$\frac{1}{3}$ unc. diam., sæpissime peltata, subtus interdum pilosula; petiolo $\frac{1}{8}$–$\frac{1}{2}$ unc. longo. *Pedunculus* $\frac{1}{18}$–$\frac{1}{12}$ unc. longus. *Fructus* $\frac{1}{24}$ unc. latus.

2. **Hydrocotyle Mannii**, *H.f.*, n. sp. Pilosa, caule tenui elongato, foliis modice petiolatis orbiculatis basi ad medium bilobis sinu angustissimo ambitu 7–9-lobis, lobis brevibus obtusis crenatis, pedunculis petiolis subæquilongis hirsutis, capitulis globosis multifloris, fructibus minimis, mericarpiis 1-costatis dorso acutis, stylis elongatis.—An *H. rotundifoliæ* Roxb. var.?

*Hab.* Fernando Po, alt. 7000 feet.

*Caules* 6–10 unc. longi, pilosi, novellis hirsutis. *Folia* $\frac{1}{3}$–$\frac{2}{3}$ unc. lata, utrinque longe setuloso-pilosa; petiolo $\frac{1}{2}$–$1\frac{1}{2}$ unc. longo; stipulis latis, membranaceis. *Capitula* $\frac{1}{10}$–$\frac{1}{8}$ unc. diam. *Fructus* $\frac{1}{30}$ unc. latus; stylo subæquilongo.—*H. rotundifoliæ* (Indiæ orientalis) proxima, sed stipulis amplis aliisque notis differt.

3. **Sanicula Europæa**, *L.* (*ante*, vi. 9).
*Hab.* Fernando Po, alt. 4000–7500 feet. Cameroons Mountains, alt. 4000–8500 feet. (Fl. Nov.–Feb.)

4. **Agrocharis melanantha**, *Hochst. in Flora*, 1844, i. 19. A. gracilis, *H.f.* (*ante*, vi. 9).
*Hab.* Fernando Po, alt. 7000 feet. Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec., Jan.)

The Cameroons Mountains' specimens prove that my *A. gracilis* is not even a constant variety of the Abyssinian plant. It attains a height of 4–6 feet.

5. **Pimpinella oreophila**, *H.f.*, n. sp. (*Gymnosciadium* ?, *ante*, vi. 10). Pubescenti-tomentosa, foliis imparipinnatis, foliolis 1–4-jugis subtus pilosis lateralibus rhombeo- v. rotundato-ovatis crenatis terminali cordato, involucro 0, involucelli foliolis paucis filiformibus pedicellos æquantibus, petalis lacinia inflexa, fructu glaberrimo, mericarpiis 9-jugis.
*Hab.* Fernando Po and Cameroons Mountains, alt. 10,000 feet.
*Herba* erecta, statura variabilis, 4–10 unc. alta. *Petioli* 2–4 unc. longi. *Foliola* ⅓–½ unc. longa, subcoriacea. *Petioli* basi longe vaginantes. *Umbellæ* radii dense v. laxe tomentosi. *Flores* minuti. *Calycis* limbus obsoletus. *Fructus* ½–1¼ lin. longus, glaberrimus, jugis prominulis, vittis inter juga solitariis obscuris.

6. **Peucedanum Petitianum**, *A. Rich. Fl. Abyss.*
*Hab.* Fernando Po, alt. 9000–9500 feet. (Fl. Dec.)

The stem is more slender and geniculate, and the rays of the umbel shorter than in Abyssinian specimens.

7. **Anthriscus Africanus**, *H.f.*, n. sp. Elata, caule basi hispido-pubescente superne divaricatim ramoso, ramis gracillimis, foliis 3-foliolatis rarius pinnatis v. 2-ternatis, foliolis inferiorum petiolulatis late ovato-cordatis grosse inæqualiter dentatis superiorum lineari-lanceolatis serratis petiolis superne retrorsum hispidis, involucris 0, umbellæ radiis 3–5 filiformibus, fructu glaberrimo.
*Hab.* Cameroons Mountains, alt. 4000–7000 feet. (Fl. Feb.)
*Herba* 3–4-pedalis; caule gracili tereti sulcato, basi hispidulo, superne glaberrimo, laxe graciliter dichotome ramoso. *Petioli* graciles, petiolulique plus minus retrorsum hispido-pilosi; foliola membranacea, pilosula, 1–2 unc. longa, grosse inæqualiter dentata et sublobata. *Umbellæ* radii 3–4, 1½–2 unc. longi, striati, gracillimi; umbellulæ radii 3–5, fructiferi fere pollicares. *Flores* parvi. *Calycis* limbus obsoletus. *Petala* lacinia brevi inflexa. *Fructus* ⅙ unc. longus, glaberrimus, anguste ovoideus, mericarpiis teretiusculis glaberrimis, jugis inconspicuis; stylopodiis elongatis; stylis recurvis, filiformibus.

## 22. ARALIACEÆ.

1. PARATROPIA MANNII, *H.f.* (*ante*, vi. 10).

*Hab.* Fernando Po, alt. 5000 feet. Cameroons Mountains, alt. 5000–7000 feet. (Fl. Dec.–Feb.)

2. PARATROPIA ELATA, *H.f.*, n. sp. Glaberrima, foliis 5-foliolatis, petiolis petiolulisque gracilibus, foliolis ovato-cordatis acuminatis subserratis nervis conspicuis lucidis, umbellulis 4–6-floris pedunculatis secus ramos simplices elongatos inflorescentiæ racemosis.

*Hab.* Cameroons Mountains, alt. 7500 feet. (Fl. Feb.)

*Arbor* 50–60-pedalis, ramis crassis, lignosis. *Petioli* teretes, spithamæi, sulcati; petiolulis 2–3-pollicaribus. *Foliola* 4–7 unc. longa, superne inter nervos reticulatim venosa. *Stipulæ* membranaceæ, subvaginantes, axillares, basi intus ad basin petioli connatæ, coriaceæ. *Inflorescentia* terminalis. Axis crassissimus; bracteis vaginantibus coriaceis pubescenti-tomentosis: rami elongati, curvi, divaricati, 6–8 unc. longi, umbellas pedunculatas racemosim gerentes, rhachi pedunculisque glaberrimis: pedunculi unciales, basi bracteolati, bracteolis linearibus deciduis lanuginosis. *Flores* parvi, pedicellique glaberrimi. *Calyx* turbinatus, limbo truncato. *Petala* 5, ovata, subacuta. *Stamina* 5, petalis æquilonga; antheræ subglobosæ. *Stylus* conicus, apice 4–5-lobus. *Ovarium* 4–5-loculare.

A noble species, very similar to *P. Mannii*, but at once distinguished by the cordate, nerved leaflets and umbellate flowers.

## 23. LORANTHACEÆ.

1. LORANTHUS (DENDROPHTHOË) OREOPHILUS, *Oliver*, n. sp. Glaber, foliis suboppositis petiolatis ovato-lanceolatis acutis coriaceis, umbellulis axillaribus pedunculatis ∞-floris, floribus pedicellatis bracteola parva oblique cupulari suffultis, corolla basi tumida, filamentis apice in connectivo continuis.—*Oliv. MSS.*

*Hab.* Cameroons Mountains, alt. 6000–8000 feet. (Fl. Dec.)

*Rami* 2–3-pedales, robusti. *Folia* interdum alterna v. subverticillata, 2½–4 unc. longa, ¾–1¾ lata, petiolo ⅓–½ unc. longo. *Pedunculus* 3–10 unc. longus. *Corolla* ¼ unc. longa, lobis denique revolutis.—*Oliv.*

## 24. RUBIACEÆ.

1. BACONIA MONTANA, *H.f.*, n. sp. Glaberrima, foliis ovato- v. obovato-lanceolatis in petiolum angustatis acuminatis, corymbis puberulis, calycis lobis oblongis obtusis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Frutex* 6–8-pedalis. *Rami* teretes. *Folia* 4–6 unc. longa, lucida, petiolis ½–¾ unc. longis; stipulæ in cupulam brevem connatæ, abrupte subulatæ. *Corymbi* breviter pedunculati, subterminales, multiflori, 1–2 unc. lati. *Pedicelli* ⅛ unc. longi. *Alabastra* ¼–⅓ unc. longa, glabra. *Calycis* tubus turbinato-campanulatus; limbi lobi subrecurvi,

tubo æquilongi, decidui. *Corollæ* tubus brevis, fauce intus villosa; lobi elongati, imbricati. *Stamina* 4, filamentis brevibus; antheris elongatis, connectivo apice producto. *Stylus* brevis, in stigma elongatum subclavatum angulatum bipartibile desinens. *Ovula* septo peltatim affixa. *Baccæ* parvæ. *Semina* orbiculata, peltata, conchoidea, ventre valde intruso, marginibus cartilagineis. *Albumen* non ruminatum.

Allied to *B. corymbosa*; but the flowers are smaller and the calyx-lobes much longer.

2. IXORA, sp.

*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Dec.)

This genus has not hitherto been found in Abyssinia. The Cameroons species resembles, but is not identical with, a Madagascar one, and is probably a nondescript.

3. VIGNALDIA OCCIDENTALIS, *H.f.*, n. sp. Caule basi suffrutescente erecto cum foliis subtus et inflorescentia tomentosis, foliis ovato-lanceolatis superne pubescentibus breviter petiolatis, stipulis in setas 5–7 tomentosas dissectis, cymis corymbosis densifloris, calycis laciniis subulato-lanceolatis tubo corollæ dimidio brevioribus, corollæ tubo elongato pubescente intus subvilloso, lobis linearibus, staminibus exsertis.

*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000–9000 feet. (Fl. Nov.–Jan.)

*Frutex* 3–4-pedalis. *V. Schimperianæ* Abyssiniæ simillima, sed differt lobis calycinis (floriferis et fructiferis) longioribus, tubo gracili corollæ dimidio brevioribus.

4. ANTHOSPERMUM ASPERULOIDES, *H.f.* (*ante*, vi. 11).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 12,000 feet. (Fl. Dec., Jan.)

5. GALIUM ROTUNDIFOLIUM, *L.* (*ante*, vi. 11).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000–12,000 feet. (Fl. Dec., Jan.)

6. GALIUM APARINE, *L.*, var. *hamatum*, H. f. (*ante*, vi. 11).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

## 25. DIPSACEÆ.

1. SCABIOSA SUCCISA, *L.*

*Hab.* Cameroons Mountains, alt. 10,500 feet. (Fl. Jan.)

A very robust form, but not otherwise to be distinguished from the European plant, which ranges from Iceland to Madeira and the Canary Islands, and from Spain to Asia Minor, the Caucasus, and Altai Mountains, but is nowhere found in Northern Africa.

## 26. COMPOSITÆ.

1. VERNONIA (STROBOCALYX) MYRIANTHA, *H. f.*, n. sp. Arborea, ramulis ultimis foliis subtus inflorescentiaque pubescentibus, foliis 8–10 unc. longis petiolatis lanceolatis eroso-dentatis acuminatis membranaceis, corymbis amplis ramosis polycephalis, capitulis 5-floris apices versus ramorum gracilium corymbi sessilibus subaggregatis, involucri squamis obtusis.

*Hab.* Fernando Po, alt. 4000–5000 feet. Cameroons Mountains, alt. 3000–7000 feet. (Fl. Dec.–Feb.)

*Arbor* parva, 20-pedalis. *Rami* crassi, læves. *Folia* superne glabra, subtus pubescentia, demum puberula v. glabrata, nervis utrinque plurimis. *Corymbi* valde ramosi, 6–10 unc. ampli, ramis gracilibus. *Capitula* ⅓ unc. longa. *Involucri* squamæ glabræ, concavæ, valde coriaceæ, apicibus rotundatis brunneis. *Receptaculum* nudum, papillosum. *Flores* involucro duplo longiores. *Pappi* setæ rigidæ, scaberulæ. *Corolla* glaberrima. *Achenium* apicem versus pilosum.

2. VERNONIA (LEPIDAPLOA) BLUMEOIDES, *H. f.*, n. sp. Herbacea, dense griseo-pubescenti-tomentosa, ramis robustis simplicibus erectis, apice corymboso-ramoso, folioso, foliis 2–3 unc. long. densis erecto-patentibus subsessilibus lanceolatis acutis integerrimis supra scaberulis subtus nervis prominulis, corymbis dense tomentosis ramosis, capitulis ½ unc. longis, involucro campanulato 20-floro, squamis ad 3–5-seriatis linearibus acutis 3-nerviis pubescentibus, pappi setis albis interioribus brevibus, achenio glaberrimo, receptaculo fimbrillifero.

*Hab.* Cameroons Mountains, alt. 4000–7000 feet. (Fl. Nov.–Jan.)

*Herba* 2–3-pedalis, subsimplex v. ramosa. *Folia* vix coriacea, ½ unc. lata, siccitate fusco-viridia. *Corymbi* ampli. *Capitula* pedunculata. *Flores* purpurei.

3. VERNONIA? (LEPIDAPLOA) MANNII, *H. f.*, n. sp. Herbacea, elata, ramosa, foliis caulinis e basi ovata profunde cordata amplexicauli elongato-lanceolatis subtus molliter albo-lanuginosis, corymbis multifloris, capitulis ½ unc. longis pedicellatis, involucri campanulati 30-flori squamis 3–4-seriatis lineari-lanceolatis longe ciliatis, pappi setis flavidis scabris 2-seriatis subæqualibus, acheniis glaberrimis, receptaculo lævi.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

*Herba* 6–10-pedalis; caule robusto, sulcato, superne pubescente, basi glabrato. *Folium* infimum unicum tantum a Mannio collectum a caulinis valde diversum (an ejusdem speciei?), 2-pedale, membranaceum, spathulato-lanceolatum, in petiolum late sinuato-alatum decurrens, margine denticulato, subtus griseo-tomentosum. *Folia* caulina 6–8 unc. longa, obtusa, denticulata, supra pubescenti-pilosa, subtus dense albo-villosa. *Corymbi* ampli, multiflori. *Flores* purpurei?, glabri, exteriores tenuiores. *Antheræ* exsertæ, bicaudatæ. *Achenium* teretiusculum, nec basi nec apice incrassatum v. dilatatum.

4. VERNONIA (LEPIDAPLOA) CLARENCEANA, *H. f.* (*ante*, vi. 11).
*Hab.* Fernando Po, alt. 7500–8500 feet. (Fl. Dec.)

5. STENGELIA CALVOANA, *H. f.*, n. sp. Ramulis velutino-pubescentibus, foliis caulinis lanceolatis sessilibus deorsum longe attenuatis basi auriculato-bilobis membranaceis acute dentatis, corymbis laxe 8–10-floris, capitulis late hemisphærico-campanulatis, involucri foliolis extimis linearibus herbaceis intermediis in laminam maximam oblongam dilatatis intimis coriaceis obtusis, pappi setis multiseriatis compressis pilosis, acheniis teretibus glaberrimis, receptaculo amplo plano lævi.
*Hab.* Cameroons Mountains, alt. 2500–7000 feet. (Fl. Dec.)
*Suffrutex* 8–12-pedalis. *Caulis* robustus, ramosus, sulcatus. *Folia* inferiora ignota, caulina 6–10 unc. longa, membranacea, superne glaberrima, subtus ad nervos pubescentia. *Capitula* longe pedunculata, 2 unc. diametr. *Involucri* squamæ crasse coriaceæ v. herbaceæ, basi confluentes, extimæ subsquarrosæ; intermediæ lamina oblonga ½ unc. longa, colorata; intimæ ∞-seriatæ, lineari-oblongæ, concavæ, coriaceæ. *Pappus* subrufescens, nitens. *Corollæ* cyaneæ; tubus gracilis, ore ampliato. *Stamina* exserta, antheris breviter caudatis.

A very fine species, allied to the following and to *S. Adoensis*, Schimp., but differing from both in the sessile cauline leaves with auriculate bases.

6. STENGELIA INSIGNIS, *H. f.*, n. sp. Ramulis robustis pubescentibus et glanduloso-pilosis, foliis graciliter petiolatis lanceolatis acuminatis basi anguste inæqualiter bilobis argute dentatis glaberrimis, corymbis laxe 10–12-floris, capitulis late hemisphærico-campanulatis, cæterum fere *S. Calvoanæ*.
*Hab.* Cameroons Mountains, alt. 3000–7000 feet. (Fl. Dec.)

A totally distinct species from *S. Calvoana*, differing in the glandular hairs of the stem and corymb, and the slender petioles of the much smaller leaves, which are attenuate at the base and there unequally bilobed. The capitula strongly resemble those of *S. Calvoana*; but the laminæ of the intermediate scales are smaller, shorter, and broader, and the innermost scales are less numerous, and have short, rather membranous appendages.

7. ADENOSTEMMA VISCOSUM, *Forst.* (*ante*, vi. 12).
*Hab.* Fernando Po, alt. 4000–8000 feet. Cameroons Mountains, alt. 7500 feet. (Fl. Dec.–Feb.)

8. MIKANIA CHENOPODIIFOLIA, *Willd.*
*Hab.* Cameroons Mountains, alt. 4000–7000 feet. (Fl. Dec.–Feb.)

A common tropical littoral plant on both coasts of Africa and in the Indian Archipelago.

9. MICROGLOSSA DENSIFLORA, *H.f.*, n. sp. Ramis teretibus, petiolis foliisque subtus glanduloso-pubescentibus, foliis 3–4 unc. long. petiolatis ovato-lanceolatis serratis longe acuminatis, corymbis densifloris, involucri campanulati squamis 3–4-seriatis obtusis marginibus ciliatis, floribus radii ligula elongata, pappo albido.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

Alte scandens. *Caulis* robustus, sulcatus. *Folia* membranacea, superne scaberula, subtus pubescenti-tomentosa; petiolo glanduloso-piloso, subvilloso. *Corymbi* ampli, densiflori. *Involucra* campanulata. *Flores* radii ligula tubo fere æquilonga.

Manifestly a species of *Microglossa*, though differing from the generic character in the much longer ligula of the ray-flowers and white pappus.

10. DICHROCEPHALA LATIFOLIA, *DC.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Jan.)

11. DICHROCEPHALA CHRYSANTHEMIFOLIA, *DC.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Jan.)

This and the above are very common tropical weeds.

12. DICHROCEPHALA OBLONGA, *H.f.* (*ante*, vi. 12).

*Hab.* Fernando Po, alt. 10,700 feet. (Fl. Dec.)

Possibly a form of *D. chrysanthemifolia*; but if so, a very peculiar one.

13. BLUMEA ALATA, *DC.*, var. *Natalensis.*

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.–Feb.)

A widely distributed and very variable African and Asiatic plant.

14. VERBESINA (PRESTINARIA) MONTICOLA, *H.f.*, n. sp. Glaberrima, caule erecto subsimplici, foliis oppositis tripartitis lobis lanceolatis acuminatis inciso-serratis, capitulis graciliter pedunculatis, fl. radii amplis elongatis ∞-nerviis, acheniis planis lineari-oblongis margine et apice setosis, aristis 2 brevibus scabridis.

*Hab.* Cameroons Mountains, alt. 5000–7000 feet. (Fl. Nov.–Jan.)

*Herba* 1–3-pedalis. *Caulis* nodosus, crassitie pennæ corvinæ, rigidulus. *Folia* subcoriacea, cum petiolo 1½–2 unc. longa, 3-secta, lacinia media sæpe 3-fida. *Pedunculi* unciales et ultra. *Capitula* radio incluso 1½ unc. lata. *Involucrum* late hemisphæricum, squamis extimis linearibus foliaceis, interioribus late oblongis obtusis chartaceis nitidis, intimis sensim in paleas receptaculi lineares concavas floribus æquilongas strictas desinentes. *Fl. radii* fœminei, 1-seriales, ligula aurantiaca, ad 10-nerviis, tubo brevissimo piloso, achenio abortivo, stylo bifido. *Fl. disci* ∞, glaberrimi, achenio corollæ æquilongo, nitido, compressissimo, interdum intus scaberulo, marginibus cartilagineis. *Pappi* aristæ scabræ, setis erectis.

15. TELEKIA AFRICANA, *H.f.*, n. sp. Tota pubescenti-tomentosa, caule apice corymbifero, foliis omnibus petiolatis hastatis obtusis grosse sinuato-crenatis utrinque pubescentibus, involucri squamis linearibus subacutis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Jan.)

*Herba* erecta, 3–4-pedalis, caule robusto dense pubescenti-tomentoso. *Folia* alterna, 2–3 unc. longa, ad basin truncatam ¾–1 unc. lata, anguste oblongo-ovata, basi hastata, angulis obtusis v. in lobulum productis. *Corymbi* 5–10-flori. *Capitula* longe pedunculata, 1½ unc. lata. *Involucri* late hemisphærici squamæ pubescentes, herbaceæ. *Fl. radii* abortivi; corolla longe ligulata, aurantiaca, 6–8-nervis, apice integra v. dentata; styli rami subelongati. *Fl. disci* glaberrimi; antheræ breviter caudatæ; achenium glaberrimum, pappo brevi albo coroniformi dentato. *Receptaculum* conicum, squamis linearibus concavis flores amplectentibus.

Of the other three species of this genus, one ranges from Hungary to Southern Russia and the Caucasus, another is confined to Lombardy and the Tyrol, and a third to Asia Minor. The genus is, however, too nearly allied to *Buphthalmum* and *Asteriscus*, which have wider Mediterranean ranges.

16. HELICHRYSUM (XEROCHLÆNA) MANNII, *H. f.* (*ante*, vi. 12).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 8000–13,000 feet. (Fl. Dec., Jan.)

Variat capitulis albis et aureis.

17. HELICHRYSUM (XEROCHLÆNA) FŒTIDUM, *Cass.* (*ante*, vi. 13).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 4000–10,000 feet.

The Abyssinian *H. glutinosum*, A. Braun, seems to be a form of this species.

18. HELICHRYSUM (ACHYROCLINE) HOCHSTETTERI, *Schultz* (*ante*, vi. 13).

*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000–8000 feet.

19. HELICHRYSUM (CHIONOSTEMMA ?) CHRYSOCOMA, *Schultz*, var. *angustifolium*, H. f. (*ante*, vi. 13).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000–11,000 feet. (Fl. Nov.–April.)

20. HELICHRYSUM (CHIONOSTEMMA ?) GLOBOSUM, *Schultz* (*ante*, vi. 13).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

21. HELICHRYSUM (STŒCHADINA) BIAFRANUM, *H.f.*, n. sp. Caule erecto virgato alato 10-pedali, laxe araneoso, foliis 2–3-unc. lineari-lanceolatis longe acuminatis sessilibus late decurrentibus marginibus recurvis, corymbis amplis ramosis, ramulis tenuibus multifloris, capitulis ¼ unc. longis aureis, involucro hemisphærico-campanulato, squamis 4–5-seriatis lineari-oblongis obtusis glaberrimis laxe imbricatis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Herba* elata, ramosa, gracilis, ramis elongatis, floriferis crass. pennæ anatinæ. *Folia* caulina ⅓–½ unc. lata, patentia, utrinque laxe araneosa, basi longe et late decurrente, marginibus subintegerrimis, nervis 3 obscuris. *Corymbus* ½-pedalis et ultra, ramis gracilibus sublaxe floriferis, pedicellis lanatis. *Involucri* squamæ ad 40, glaberrimæ, nitidæ, enerves, scariosæ, omnes exacte lineares, subacutæ. *Flores* ad 40. *Receptaculum* alveolatum. *Flores* radii tenues, ♀. *Pappi* pili tenues, scabruli.

22. GYNURA VITELLINA, *Benth.* (*ante*, vi. 14), var. *gracilis*. Caule gracili, foliis angustioribus, capitulis minoribus, involucri squamis paucioribus.

*Hab.* Fernando Po, alt. 2000–8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. June–Nov.)

Also an Abyssinian plant.

23. SENECIO (OBÆJACA) CLARENCEANUS, *H.f.* (*ante*, vi. 14), var. *β*. Capitulis majoribus rubris v. albis.

*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 7000–11,000 feet. *β*. Cameroons Mountains, alt. 11,000 feet. (Fl. Dec.)

24. SENECIO (ARBOREÆ) MANNII, *H.f.* (*ante*, vi. 14).

*Hab.* Fernando Po, alt. 6000 feet. Cameroons Mountains, alt. 2500–7500 feet.

25. SENECIO (DISCOIDEI) BOJERI, *DC.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Jan.)

Apparently the same as the Madagascar species.

26. SENECIO (ECALYCULATI) BURTONI, *H. f.*, n. sp. Herbaceus, elatus, caule robusto foliisque albo-araneosis, foliis caulinis lineari-oblongis v. elongato-oblongis acuminatis sessilibus basi decurrenti-auriculatis argute serrulatis, supremis ovato-lanceolatis, corymbis polycephalis glabratis, capitulis graciliter pedunculatis ¾ unc. longis, involucri basi tomentosi squamis extimis paucis filiformibus, interioribus anguste linearibus acuminatis late membranaceo-marginatis, ligulis aurantiacis capitulo æquilongis.

*Hab.* Cameroons Mountains, alt. 8000–12,000 feet. (Fl. Dec., Jan.)

*Herba* robusta, 3–4-pedalis, ramosa, ramis validis canaliculatis. *Folia* caulina spithamæa et ultra, subtus nivea, laxe lanata, supra araneosa,

lineari-oblonga multinervia, obtusa, dentibus marginalibus parvis callosis. *Fl. disci* 30–40, glaberrimi, pappo albo. *Achenia* brevia, costata, glaberrima. *Receptaculum* planiusculum.

A fine species, very nearly allied to the Abyssinian *S. Steudelii*, Hochst.; but it has more minutely toothed and coriaceous leaves: also allied somewhat to *S. alpinus*, *auratus*, &c., but more branched and robust, with sessile, much larger, and differently shaped leaves.

27. LACTUCA (SCARIOLA) CAPENSIS, *Thunb.*, var. *integrifolia*, *DC. Prodr.* vii. 136.

*Hab.* Cameroons Mountains, alt. 5000–7500 feet. (Fl. Nov., Dec.)

Certainly identical with the South-African plant, which extends throughout the Cape Colony to Natal, ascending in the latter country to 5000 feet.

28. LACTUCA (SCARIOLA) GLANDULIFERA, *H. f.*, n. sp. Glandulosa, hispidula, caulibus angulatim flexuosis, ramis apice divaricatim paniculato-ramosissimis, foliis ultra medium ovato-hastatis acutis denticulatis infra medium in petiolum late alatum basi cordato-bilobum abrupte contractis, pedunculis gracilibus ebracteatis, capitulis 3–4-floris, achenio rostro suo paulo longiore.

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.–Feb.)

*Herba* gracilis, scandens, 8-pedalis, diffuse ramosa, ramis paniculisque setis glandulosis sparsis. *Folia* 1 unc. longa, membranacea, utrinque pilosula. *Capitula* ½ unc. longa, angusta, squamis extimis brevibus, interioribus e basi ovato-lanceolata longe linearibus apice incrassatis. *Pappus* albus. *Achenia* oblonga, acuta, utrinque medio longitudinaliter anguste 3–5-alata, rostro gracili.

Very near to the Abyssinian *L. paradoxa*, Schultz, in every respect but the glandular setæ of the stem and inflorescence.

29. SONCHUS ANGUSTISSIMUS, *H. f.*, n. sp. Caule erecto robusto glauco foliisque glaberrimis, foliis e basi lanceolato-hastata anguste elongatis sensim attenuato-acuminatis margine revolutis retrorsum aculeolatis integris v. lobulis 1–2 lineari-elongatis recurvis auctis, corymbo umbellato, pedunculis nudis, capitulis setosis basi lanatis.

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Nov.–Jan.)

*Herba* 4–6-pedalis. *Caulis* erectus, crassit. digiti, striatus, glaucus, simplex. *Folia* spithamæa ad pedalia, vix ¼ unc. lata, subcoriacea, enervia, costa subtus prominula, lobis basi elongato-subulatis deflexis. *Corymbi* 8–12-cephali, pedunculis 1–3-cephalis, basi bracteis setaceis, glabris v. sublanatis, 1 unc. diametro. *Involucri* squamæ lineares, obtusæ, basi lana immersæ; exteriores setis subflexuosis hirsutæ. *Achenia* parva, oblonga, utrinque obtusa, lævia, brunnea, compressa, utrinque sub-6-costata, costis obscure transverse undulatis. *Pappus* albus.

A very distinct species, approaching *S. palustris* in habit. It is very nearly allied to a South African plant, of which I have seen only very bad specimens, and which wants the recurved aculei on the edges of the leaf.

30. ANISORAMPHUS HYPOCHÆROIDES, *DC.*?
*Hab.* Cameroons Mountains, alt. 7000–13,500 feet. (Fl. Dec., Jan.)
*Herbacea*, erecta. *Radix* perpendicularis, fusiformis, perennis. *Folia* radicalia spithamæa, sessilia, a basi ad apicem sensim dilatata, vix 1 unc. lata, membranacea, apice rotundata, eroso-dentata, dentibus retrorsis. *Scapus* pilosulus, simplex v. apicem versus divisus, nudus, folio ovato-lanceolato basi auriculato 2-lobo auctus. *Capitula* ½–¾ unc. lata, longe pedunculata, pedunculo bracteolis paucis filiformibus aucto. *Involucrum* turbinato-campanulatum, foliolis 3–4-seriatis lineari-lanceolatis cum pedunculis viscoso-puberulis. *Receptaculum* fimbrilliferum. *Achenia* pappo pallide fusco æquilonga.

A remarkable plant, of which I have seen no original specimens (from South Africa); it is probably referable to *Hieracium*.

## 27. CAMPANULACEÆ.

1. WAHLENBERGIA POLYCLADA, *H.f.* (*ante*, vi. 15).
*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 7000-8000 feet. (Fl. Dec., Jan.)

2. WAHLENBERGIA ARGUTA, *H.f.* (*ante*, vi. 15).
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000–9000 feet. (Fl. Dec.)

3. CEPHALOSTIGMA PERROTETII, *A.DC. Prodr.* vii. 420. C. bahiense, *DC. l. c.* 421.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov., Dec.)

Also found on the Niger river by Barter; the Gaboon by Mann; in Senegambia by Perrottet; in South America, at Bahia, by Salzmann and Gardner; and at Tarapoto, Peru, by Spruce. It is clearly allied to the Abyssinian and Indian *C. hirsutum* (*Schimperi*, Hochst.), but differs in the calyx-lobes. Flowers blue.

4. LOBELIA (TUPA) COLUMNARIS, *H.f.* (*ante*, vi. 14).
*Hab.* Fernando Po. Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)
*Herba* 6-pedalis.

5. LOBELIA ACUTIDENS, *H.f.*, n. sp. Glaberrima, caulibus tenuibus prostratis, foliis petiolatis ovatis v. ovato-rotundatis acutis grosse acute

dentatis, pedunculis axillaribus solitariis 1-floris foliis longioribus, calycis setulosi lobis ovato-subulatis corolla triente brevioribus.

*Hab.* Fernando Po, alt. 9000 feet. (Fl. April.)

*L. Schimperi*, Hochst., affinis et ejusdem magnitudinis; sed folia latiora, argute dentata; flores minores, et calycis lobi breviores et latiores.

## 28. ERICEÆ.

1. LEUCOTHOË ANGUSTIFOLIA, β. pyrifolia, *DC.* (*ante*, vi. 15).

*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 4000–8000 feet. (Fl. Dec., Jan.)

2. BLÆRIA SPICATA, *Hochst.* (*ante*, vi. 15).

*Hab.* Fernando Po, alt. 10,700 feet. Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Nov., Dec.)

3. ERICINELLA MANNII, *H. f.* (*ante*, vi. 16).

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 4000–11,000 feet. (Fl. Dec.)

## 29. PRIMULACEÆ.

### ARDISIANDRA, *H. f.*, gen. nov.

*Calyx* 5-partitus, laciniis triangulari-ovatis membranaceis acuminatis. *Corolla* calyce vix longior, campanulata, profunde 5-loba, tubo brevi, lobis oblongis ciliatis. *Stamina* 5, disco tenui annulari corollæ basi adhærente inserta, inclusa, filamentis brevibus subulatis; antheræ sagittato-ovatæ, acuminatæ. *Ovarium* superum, subglobosum; stylus gracilis, stigmate capitulato; ovula ∞. *Capsula* calyce inclusa, basi cum eo adhærente, depresso-globosa, apice dentibus 5–8 cartilagineis dehiscens. *Semina* ∞, angulata, testa brunnea granulata. *Embryo* transversus.—*Herba* repens, tenella, molliter pilosa, pilis flexuosis, caulibus prostratis. *Folia* sparsa, graciliter petiolata, ovato-rotundata, 3–5-loba v. subangulata, basi profunde cordato-biloba, grosse acute dentata, utrinque pilosula, 1 poll. diametro. *Flores* ¼ poll. lati, axillares, solitarii v. 2–3-ni, brevi-pedicellati; pedicellis basi bracteolatis, petiolo brevioribus, gracilibus; bracteolis setaceis. *Calyx* viridis, foliolis marginibus recurvis. *Corolla* alba, membranacea. *Capsula* pilosa, viridis, dentibus albis recurvis.

1. ARDISIANDRA SIBTHORPIOIDES, *H. f.* (Plate I.)

*Hab.* Fernando Po, alt. 7500 feet (fl. May). Cameroons Mountains, alt. 7000 feet (fll. Dec.).

Genus *Androsacæ* affine, differt habitu, antheris acuminatis, stylo elongato, capsula apice tantum dehiscente, et seminibus plurimis.

## 30. Myrsineæ.

1. Mæsa Indica, *A. DC.* (*ante*, vi. 16).
*Hab.* Fernando Po, alt. 5000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. and frt. Nov., Dec.)

2. Myrsine melanophlœos, *Br.*, *A. DC. Prodr.* viii. 97. An *M. Simensis*, Hochst., A. DC. *l.c.*?
*Hab.* Cameroons Mountains, alt. 4000–7500 feet. (Fl. Dec., Jan.)

## 31. Loganiaceæ.

1. Anthocleista scandens, *H. f.* (*ante*, vi. 16).
*Hab.* Fernando Po, alt. 5000 feet. (Fl. Dec.)

2. Nuxia congesta, *Br. D.C. Prodr.* x. 435.
*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec., Jan.)
*Arbor* 30–40-pedalis. *Folia* variant acuta et obtusa in eadem stirpe.

An Abyssinian mountain species.

## 32. Gentianeæ.

1. Sebæa brachyphylla, *Griseb.* (*ante*, vi. 16).
*Hab.* Fernando Po, alt. 8500–10,000 feet. Cameroons Mountains, alt. 7000–8000 feet. (Fl. Nov., Dec.)

2. Swertia pumila, *Hochst.* Annua, glaberrima, caule erecto 4-gono angulis subcarinatis, foliis parvis obovatis v. obovato-spathulatis breviter petiolatis integerrimis obtusis, floribus longe pedicellatis 5-meris, sepalis oblongo-spathulatis obtusis corolla dimidio brevioribus, glandulis nectariferis 2 oblongis marginibus laxe setosis.
*Hab.* Cameroons Mountains, alt. 8000–10,000 feet. (Fl. Jan.)
*Herba* gracilis, spithamæa ad pedalem, subramosa. *Folia* parva, $\frac{1}{3}$–$\frac{3}{4}$ unc. longa, coriacea, crassiuscula; radicalia pauca. *Flores* subcorymbosi, longe graciliter pedicellati, $\frac{1}{2}$ unc. diametro, flavi. *Sepala* late v. anguste oblonga. *Glandulæ* nectariferæ incrassatæ, tumidæ.

Mann's smaller specimens differ from the Abyssinian in no respect; nor do his larger ones, except in size.

3. Swertia Mannii, *H. f.*, n. sp. Gracilis, annua, glaberrima, caule obscure 4-carinato, foliis lineari-lanceolatis obtusiusculis, floribus graciliter pedicellatis 5-meris, sepalis linearibus corolla 4-plo brevioribus, corollæ lobis lineari-oblongis, foveis nectariferis oblongis, marginibus longe fimbriatis.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Nov.–Jan.)
Spithamæa. *Folia* $\frac{1}{2}$–1 unc. longa, $\frac{1}{12}$ lata, crassiuscula. *Flores* fere $\frac{1}{2}$ unc. diametro, flavi. *Sepala* lobique corollæ quam præcedentis angustiora.

It is remarkable that this genus should be common in tropical mountainous Africa, but absent in South Africa: several Abyssinian species are described.

4. SWERTIA CLARENCEANA, *H. f.* (*ante*, vi. 16).
*Hab.* Fernando Po, alt. 8500–10,700 feet. Cameroons Mountains, alt. 6000–7000 feet. (Fl. Nov., Dec.)

The Cameroons Mountains specimens are much more slender than the Fernando Po ones, with rather larger flowers and smaller calyces, closely resembling *S. Abyssinica*, but the cauline leaves are not truncate at the base as in that plant. It may prove to be a form of *S. pumila*, which is extremely variable.

### 33. BORAGINEÆ.

1. CYNOGLOSSUM MICRANTHUM, *Desf.*, *A. DC. Prodr.* x. 149. An *C. furcatum*, Forsk.?
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)

Apparently the same as the Abyssinian and Indian plant, which is also found at Cape Palmas and in South Africa (*Echinospermum cynoglossoides*, Lehm, Drège in Hb. Hk.).

2. CYNOGLOSSUM LANCIFOLIUM, *H. f.*, n. sp. Caule ramoso cum foliis hispido-pilosis, foliis caulinis late oblongo- v. ovato-lanceolatis valde acuminatis basi in petiolum angustatis superne pilis basi albo-pustulatis, racemis basi bracteatis, pedicellis hispido-tomentosis, florentibus floribus longioribus, fructiferis elongatis decurvis, floribus majusculis, calycis lobis breviter ovatis subacutis corolla multo brevioribus, corollæ lobis obtusis appendicibus bilobis glandulosis, acheniis depressis ambitu breviter glochidiatis.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)
*Herba* 3–4-pedalis. *Folia* caulina 3–4 unc. longa, 2–2½ unc. lata, nervis subparallelis. *Racemi* elongati. *Flores* cærulei, ⅛–½ unc. diametro. *Pedunculi* fructiferi fere unciales. *Achenia* subsolitaria, late ovato-orbiculata, ambitu glochidiata, glochidiis brevibus validis multiseriatis, facie superiore lævi leviter rugosa, inferiore glochidiata, cicatrice triangulari.

Allied to the Abyssinian *L. acutifolium*, Steud.; but the leaves are more lanceolate, long-acuminate, and the whole plant more hispid.

3. MYOSOTIS STRICTA, *Link.* M. hispida, *Schlecht.*
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 8000–10,000 feet. (Fl. Dec.)

### 34. SCROPHULARINEÆ.

1. LIMOSELLA AQUATICA, *L.*, var. *tenuifolia* (*ante*, vi. 19).
*Hab.* Fernando Po, alt. 9000–10,000 feet. (Fl. Dec.)

2. VERONICA (VERONICASTRUM) MANNII, *H.f.* (*ante*, vi. 19).
*Hab.* Fernando Po, alt. 10,700 feet. Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec.)

3. VERONICA (CHAMÆDRYS) AFRICANA, *H.f.*, n. sp. Pilosa, caule debili prostrato, foliis longe petiolatis ovatis obtusis grosse crenato-serratis, pedunculis folio subæquilongis 2-floris, sepalis oblongis obtusis pilosis capsula plano-compressa 2-loba pilosa longioribus.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)
*Herba* habitu et facie *V. montanæ. Caules* debiles, 6–10 unc. longi, ubique pilosi. *Folia* pollicaria, utrinque pilosa, petiolo ½ unc. longo. *Pedunculi* graciles, axillares. *Pedicelli* filiformes, ¼ unc. longi, bracteis linearibus. *Corolla* ½ unc. diam., lobis late oblongis obtusis. *Capsula* calyce inclusa latior quam longa. *Semina* ∞, parva, oblonga, compressa, pallida, testa granulata. *Stylus* capsulæ æquilongus.

A very European form, and similar to *V. montana*, from which it differs in the smaller, more turgid capsules. It is also closely allied to *V. Petitiana* and *Abyssinica*, both of Abyssinia, which have shorter petioles, and leaves abrupt or cordate at the base.

4. SIBTHORPIA EUROPÆA, *L.*, var. *Africana.* Flore purpureo.
*Hab.* Fernando Po, alt. 7500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

The European *Sibthorpia* has flowers part rose-coloured and part yellow; the var. *Africana* is stated to be yellow-flowered; but Mr. Mann describes those of his plant as purple. The species ranges from England to the Azores and Balearic Islands, Madeira, Peru, and Mexico.

5. CELSIA DENSIFOLIA, *H. f.*, n. sp. Caule erecto foliisque subtus pubescenti-tomentosis, foliis confertis breviter petiolatis anguste oblongo-lanceolatis crenulatis subacutis superne puberulis, racemo simplici stricto elongato multifloro glanduloso-pubescente, bracteis ovatis acuminatis denticulatis pedunculos fructiferos subæquantibus, calycis lobis lanceolatis acuminatis capsula brevioribus.
*Hab.* Fernando Po, alt. 8500 feet. (Fl. April.)
*Caulis* basi ramosus, ramis strictis subrobustis. *Folia* patentia v. reflexa, subimbricata, 2 unc. longa, superiora sensim breviora et magis ovata, supra reticulatim venosa. *Racemus* 1–2-pedalis, strictus, simplex. *Pedunculi* floriferi ¼ unc., fructiferi ½ unc. longi, patentes, robusti. *Calycis* laciniæ ¼ unc. longæ. *Corolla* ½–⅔ unc. diametro. *Filamenta* omnia villosa, loculis antherarum majorum breviter decurrentibus. *Capsula* ovoidea, $^{1}$ unc. longa. *Semina* minuta, pallida, profunde sulcata.

6. ALECTRA SENEGALENSIS, *Benth. in A. DC. Prodr.* x. 339.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Apparently the same as the Senegambian plant.

7. BARTSIA ABYSSINICA, *Hochst.*, *Benth. in A. DC. Prodr.* x. 545.
*Hab.* Cameroons Mountains, alt. 7000–9000 feet. (Fl. Nov., Dec.)

Quite the same as the Abyssinian plant, in habit, flowers, and foliage. The capsules are linear-oblong, and pubescent, but vary greatly in shape, sometimes broadly oblong.

8. SOPUBIA TRIFIDA, *Ham.*, var. β. *Madagascariensis*, Benth.? in A. DC. Prodr. x. 522.
*Hab.* Cameroons Mountains, alt. 6000–7000 feet. (Fl. Dec.)

Very similar to the Madagascar species, as also to the *S. Dregeana* of South Africa, *ramosa* of Abyssinia, and *filiformis* of Guinea, which may all belong to one species. It is, however, of a shorter and more robust habit than any of them—a difference possibly due to locality.

### 35. SOLANEÆ.

1. SOLANUM NIGRUM, *L.* Forma robusta, caule flexuoso tenuiter alato, floribus majusculis.
*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec., Jan.)

2. SOLANUM INDICUM, *L.*
*Hab.* Fernando Po, alt. 6000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–Jan.)

The *S. Adoense*, Hochst., of Abyssinia, seems to be the same plant.

3. DISCOPODIUM PENNINERVIUM, *Hochst.*, *A. DC. Prodr.* xiii. 478.
*Hab.* Fernando Po, alt. 4000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.–Feb.)

An Abyssinian mountain plant.

### 36. LENTIBULARINEÆ.

1. UTRICULARIA ORBICULATA, *Wall.* (*ante*, iii. 187).
*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Nov.)

Professor Oliver, who has examined this (and the following) for me, pronounces it to be absolutely identical with the Indian species (which ranges from Nepal and the Khasia Mountains to Ceylon and Malacca), even to the structure of the glochidiate seeds.

2. UTRICULARIA, sp. Without flower.
*Hab.* Cameroons Mountains, alt. 4000–6000 feet. (Fl. Nov.)

A small, slender species, 2–5 inches long, with linear spathulate leaves 1½–2 inches long, and emitting distinct utriculiferous fibres from the root. Scape 1–2-flowered. Calyx-lobes very unequal: lower smaller, oblong-ovate, emarginate; upper ovate-lanceolate, rather obtuse.—D. O.

## 37. LABIATÆ.

1. PLECTRANTHUS (COLEOIDES) GLANDULOSUS, *H. f.* (*ante*, vi. 17).
*Hab.* Fernando Po and Cameroons Mountains, alt. 7000 feet. (Fl. Dec.–April.)

2. PLECTRANTHUS (GERMANEA) INSIGNIS, *H. f.*, n. sp. Elatus, ramosus, superne glanduloso-tomentosus, foliis amplis oblongo-lanceolatis membranaceis grosse dentatis, paniculis amplis, corollæ flavæ tubo basi gibbo, calyce post anthesin valde aucto.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)
*Herba* 10–15-pedalis, aspectu *Salviæ* giganteæ. *Folia* pedalia, glabrata, superne secus nervos pubescentia, petiolo 1 unc. longo. *Paniculæ* late diffuse ramosæ, 2-pedales, ramis glacilibus glanduloso-pilosis et tomentosis. *Verticillastri* laxi. *Pedicelli* ¼–¾ unc. longi. *Flores* magni. *Calyx florifer* parvus, tubo brevi cylindrico, lobis subulatis recurvis. *Corolla*, ut videtur ex exemplaribus siccis, aurea, ½–¾ unc. longa, tubo basi contracto gibbo repente ampliato, labiis amplis. *Calyx fructifer* fere uncialis, glanduloso-pubescens, cylindricus, lente curvus, labio superiore ovato acuto marginibus recurvis; inferiore 4-fido, lobis lateralibus brevibus late ovato-subulatis, intermediis longe subulatis lente incurvis. *Nuces* magnæ, compressæ, late ovoideæ, glaberrimæ, læves.

A noble species, remarkable for its great size, Salvoid aspect, and golden flowers.

3. PLECTRANTHUS (ISODON) RAMOSISSIMUS, *H. f.* (*ante*, vi. 17).
*Hab.* Fernando Po, alt. 5000 feet. Cameroons Mountains, alt. 7000 feet.

4. PLECTRANTHUS (HETEROCALYX) DECUMBENS, *H. f.*, n. sp. Humilis, caule basi decumbente pubescenti-piloso, foliis ⅓ unc. longis petiolatis late ovatis obtusis grosse crenatis, racemo glanduloso-pubescente elongato simplici multifloro, verticillastris 8–10-floris, floribus breviter pedicellatis, calycibus parvis fructiferis hiantibus 2-lobis, pedicellis decurvis, corolla defracta calyce multo longiore.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)
*Herba* 1–2-pedalis, glanduloso-punctata, caule glanduloso-piloso. *Folia* subcoriacea, petiolo lamina breviore utrinque laxe piloso. *Racemi* 3–4 unc. longi, simplices, striati. *Verticillastri* subconferti, pedicellis ⅙ unc. longis, floriferis patentibus, fructiferis decurvis. *Calyx* fructifer,

parvus, tubo pubescente hemisphærico, limbi lobo superiore lato ovato obtuso recurvo, lateralibus parvis porrectis, inferiore adscendente oblongo obtuso superiori æquilongo apice retuso. *Corolla* ⅓ unc. longa, puberula, tubo brevi basi modice defracto, lobo superiore brevi, inferiore elongato anguste cymbiformi punctato. *Stamina* libera.

A small species, closely allied to *P. Palisoti*, but much smaller, the flowers more numerous, the lateral calyx-lobes larger, the lower one not biaristate, and the corolla is very many times the length of the calyx.

5. **Coleus (Aromaria) glandulosus**, *H. f.*, n. sp. 2–3-pedalis, laxe glanduloso-pilosus, foliis subsessilibus 1½–2 unc. longis ovatis subacutis grosse serratis, racemis simplicibus elongatis, verticillastris remotis dense 8–10-floris, floribus breviter pedicellatis, calycibus fructiferis pendulis, corollæ tubo gracili modice defracto limbo subæqualiter bilabiato longiore.

*Hab.* Cameroons Mountains, alt. 2500–7000 feet. (Fl. Nov., Dec.)

*Caulis* gracilis, laxe ramosus, pilis mollibus laxis. *Folia* nunc sessilia, nunc breviter petiolata, utrinque pilosa. *Racemi* floriferi 2–3-, fructiferi 8–10-pollicares, graciles, erecti. *Calyx* fructiferus clausus, deflexus, intus nudus, ¼ unc. longus, labio superiore lente recurvo ovato acuminato, inferiore 3-fido, dentibus subulatis. *Corolla* ¼–⅓ unc. longa. *Filamenta* in tubum connata.

I have a bad specimen of apparently the same plant collected in Abyssinia by Parkyns.

6. **Coleus (Solenostemon) tenuicaulis**, *H. f.*, n. sp. 6–12 unc. altus, laxe molliter glanduloso-pilosus, caule erecto ramoso, ramis gracilibus, foliis ¼–⅔ uuc. longis petiolatis ovatis serratis, racemis elongatis compositis puberulis, pedicellis gracilibus racemoso-3–5-floris floribusque glanduloso-puberulis, calycibus minutis, fructiferis hemisphæricis oblique 5-fidis lobis subulatis, superiore recurvo, corollæ tubo brevi defracto, labio superiore brevi, inferiore elongato cymbiformi.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Statura valde variabilis, 2–12 unc., tenuis, annua. *Petioli* folio multo breviores. *Folia* utrinque subscabrulo-pilosa. *Racemi* interdum 8 unc. longi, laxe ramosi. *Calyx* fructifer ⅛ unc. longus, lente curvus, subhorizontalis, fauce glaberrima. *Corolla* ⅓ unc. longa, glabrata. *Filamenta* ad medium monadelpha.

7. **Coleus (Solenostemon) Mannii**, *H. f.*, n. sp. Glaberrimus nisi racemus puberulus, 2–3-pedalis, caule crasso 4-gono, foliis 1–1½ unc. longis petiolatis ovatis v. ovato-lanceolatis acutis grosse crenatis crassiusculis, racemo stricto erecto simplici, verticillastris 15-floris, pedicellis in phalanges 2 oppositas aggregatis gracilibus, calyce parvo, bi-

labiato hiante, corollæ tubo brevi defracto, labio superiore brevissimo, inferiore elongato cymbiformi.

*Hab.* Cameroons Mountains, alt. 5000–6000 feet. (Fl. Nov.)

*Caulis* robustus, glaberrimus, crassitie pennæ anatinæ, 4-gonus, internodiis brevibus. *Folia* purpureo variegata, lamina basi in petiolum brevem angustata. *Racemi* 4 unc. longi, stricti, graciles, pedicellis patentibus $\frac{1}{4}$–$\frac{1}{3}$ unc. longis. *Calyx* glanduloso-puberulus, lobo superiore recurvo obtuso, lateralibus minutis, inferiore superiorem æquante apice bifido; fauce glaberrima. *Corolla* $\frac{1}{3}$ unc. longa, glabra. *Filamenta* ad medium monadelpha.

The calyx of this plant is of the same form as that of *Plectranthus decumbens*, of which it is a near ally, but the monadelphous stamens remove it to *Coleus*.

8. Pycnostachys abyssinica, *Fresen.* (*ante*, vi. 17).

*Hab.* Fernando Po, alt. 7000 feet. Cameroons Mountains, alt. 6000 feet. (Fl. Dec.)

Specimens from the Cameroons Mountains are more glabrous than those from Fernando Po, in this respect approaching the Madagascar *P. cærulea* and the S.-African *P. reticulata.* All may be forms of one.

9. Micromeria punctata, *Br.*, *Benth. in DC. Prodr.* xii. 230.

*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec., Jan.)

Certainly the same as the Abyssinian plant, and possibly a form of a South-European one.

10. Calamintha Simensis, *Benth.* (*ante*, vi. 18).

*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000–10,500 feet. (Fl. Dec.)

11. Nepeta (Pycnonepeta) robusta, *H.f.*, n. sp. Erecta, robusta, ramosa, pubescenti-hispidula, foliis breviter petiolatis ovatis obtusis grosse serratis coriaceis reticulatis, verticillastris in spicas densas cylindricas terminales dispositis, bracteis lanceolato-subulatis, calycem rectum tubulosum æquantibus, corollæ tubo exserto.

*Hab.* Cameroons Mountains, alt. 6000–8000 feet. (Fl. Nov., Dec.)

*Herba* 3–4-pedalis, caule valido, ramis crassitie pennæ anserinæ, pilis patulis subhispidis hirsuta. *Folia* 1–1$\frac{1}{2}$ unc. longa, rigidula, utrinque rugosa, supra glabra, subtus pilosa. *Cymarum* spicæ 1 unc. longæ, obtusæ, densifloræ. *Flores* breviter graciliter pedicellati, flavi?. *Calyx* $\frac{1}{8}$–$\frac{1}{4}$ unc. longus, 15-nervius, pilosus, dentibus subulatis. *Corolla* tubo pubescente exserto, lobis oblongis obtusis.

Closely allied to the Abyssinian *N. ballotifolia*, Hochst., which has broader bracts and much larger flowers.

12. STACHYS ACULEOLATA, *H.f.* (*ante*, vi. 18).
*Hab.* Fernando Po, alt. 9000 feet. (Fl. Dec.)

13. LEUCAS (HEMISTOMA) DEFLEXA, *H.f.*, n. sp. Herbacea, ramosa, elata, cano pubescens, foliis lanceolatis dentato-serratis, verticillastris densifloris globosis, calycibus hispidis membranaceis ore repente deflexo dentibus 8–10 brevibus late ovatis setaceis.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–Feb.)
*Herba* 4–5-pedalis, caule robusto. *Folia* petiolata, 2–3 unc. longa, membranacea, basi attenuata. *Verticillastri* $\frac{3}{4}$–1 unc. diametro. *Bracteæ* calyci æquilongæ, rigidæ, setaceæ, ciliatæ. *Corolla* parva, galea villosa.

Allied to *L. urticæfolia* of Abyssinia, Arabia, and India, but differing remarkably in the foliage, and in the deflexed mouth of the calyx.

14. LEUCAS (LOXOSTOMA) OLIGOCEPHALA, *H.f.*, n. sp. Herbacea, pubescenti-pilosa, caulibus ascendentibus gracilibus simplicibus, foliis parvis oblongo-lanceolatis obtusis grosse pauciserratis, verticillastris globosis subsolitariis, terminalibus longe pedunculatis, bracteis setaceis calycis dimidium æquantibus.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Nov.–Jan.)
*Herba* rigidula, 1–2-pedalis, ubique pilis patentibus v. deflexis subtomentosa. *Caules* subsimplices v. ramis paucis elongatis. *Folia* vix petiolata, $\frac{1}{2}$ unc. longa, subcoriacea, subtus nervis prominentibus, utrinque pilosa. *Verticillastri* foliis 2 brevibus involucrati, $\frac{1}{2}$–$\frac{3}{4}$ unc. diametro, densiflores. *Bracteæ* subulatæ, rigidæ, ciliatæ. *Calyx* tubulosus, incurvus, 2-labiatus, hirsutus, dentibus longe subulatis. *Corolla* parva, albo villosa.

A very distinct species, clearly belonging to Bentham's previously monotypic section *Loxostoma*.

### 38. PLANTAGINEÆ.

1. PLANTAGO PALMATA, *H.f.* (*ante*, vi. 19).
*Hab.* Fernando Po, alt. 7500–8000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

### 39. POLYGONEÆ.

1. RUMEX ABYSSINICUS, *Jacq.* (*Meisn. in DC. Prodr.* xiv. 68), var. Foliis subtus pilosiusculis.

Altogether the same as the Abyssinian plant, except that there are more scattered hairs on the under side of the leaf. The species is a native also of Bourbon, and of cornfields in Eastern tropical Africa (*Kirk*). Mann states that it attains a height of 8 feet. According to a note on Roth's Abyssinian specimen, the root is

tuberous, and its juice is mixed with butter to give it a brick-red colour.

2. RUMEX OBTUSIFOLIUS, *L.*, var. *Steudelii.* (R. Steudelianus, *Meisn. in A. DC. Prodr.* xiv. 56. R. Nepalensis, *Spreng.*, *Meisn. l. c.* 55. R. hamatus, *Trev.*, *Meisn. l. c.* 56.) Foliis lanceolatis, acuminatis basi angulatis, calycibus valvulis ecallosis setis utrinque 6–10 hamatis.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov., Dec.)

A very common tropical and intertropical form of the common *R. obtusifolius*, found abundantly in Abyssinia, South Africa, throughout the hilly parts of the East Indies, &c. It has very many names in systematic works. A. Richard, in his Abyssinian Flora, remarks that the leaves vary from attenuate to cordate at the base. In our specimen the upper are very acute.

3. POLYGONUM NEPALENSE, *Meisn.*, *A. DC. Prodr.* xiv. 128.
*Hab.* Fernando Po, alt. 7500 feet.

A common Indian and Abyssinian plant.

### 40. AMARANTHACEÆ.

1. ACHYRANTHES ARGENTEA, *L.*
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

2. CYATHULA CYLINDRICA, *Moq.-Tand. in A. DC. Prodr.* xv. pl. 2, var. *Schimperiana.* C. Schimperiana, *Moq. l. c.* Foliis lanceolatis
*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.–Feb.)

The original or short-leaved form of this same plant occurs in Madagascar, South Africa, and in East tropical Africa (Manganja range, Meller in Livingstone's Cape), but not in Abyssinia, where the form *Schimperiana* only occurs.

### 41. THYMELEÆ.

1. LASIOSIPHON GLAUCUS, *Fresen.*, *Meisn. in DC. Prodr.* xiv. 593.
*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Dec., Jan.)

Mann's plant has rather longer, narrow lobes to the perianth, than an Abyssinian specimen of what we take to be this plant (collected by Mr. Plowden), of which we have no authentic specimens.

2. PEDDIEA PARVIFLORA, *H. f.* (*ante*, vi. 20).
*Hab.* Fernando Po, alt. 5000 feet. (Fl. Nov.)

### 42. SANTALACEÆ.

1. THESIUM TENUISSIMUM, *H. f.* (*ante*, vi. 19).
*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 8000–9000 feet. (Fl. Nov.–Jan.)

### 43. EUPHORBIACEÆ.

1. EUPHORBIA AMPLA, *H. f.* (*ante*, vi. 20), var. *tenuior*. Ramulis tenuibus, foliis involucralibus minoribus.
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Nov., Dec.)

The Cameroons specimens are of a slender variety of the Fernando Po species.

2. PHYLLANTHUS, n. sp.?
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–Feb.)

A common herbaceous erect form of the genus, which I cannot identify, but am unwilling to describe in the present entangled condition of the species hitherto known.

3. CLAOXYLON MANNII, *H. f.* (*ante*, vi. 20).
*Hab.* Fernando Po, alt. 5000 feet. (Fl. Oct.)

### 44. URTICEÆ.

1. PARIETARIA MAURITANICA, *L.*, var. *a. erecta*, Wedd. Monogr. 513 (*ante*, vi. 20).
*Hab.* Fernando Po, alt. 8000 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

The leaves are 3-nerved from the very base; otherwise it more resembles *P. officinalis*.

2. PARIETARIA DEBILIS, *Fort.*, var. *β. diffusa*, Wedd. Monogr. 515.
*Hab.* Cameroons Mountains; no elevation given; with plants of the temperate region.

This has the fructiferous perigonium of *P. debilis*, but the terminal apiculus to the fruit of *P. Lusitanica*. The species is universally diffused.

3. LAPORTEA (SCLEPSIA) ALATIPES, *H. f.*, n. sp. Herbacea, grosse setigera, foliis ovatis acuminatis grosse dentatis, inflorescentia axillari, pedunculis elongatis, pedicellis fœmineis alatis flabellatim connatis, achenii margine incrassato.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)
*Herba* 3-pedalis, setis rigidis ubique horrida. *Folia* 4–5 unc. longa, petiolis gracilibus longiora. *Inflorescentia* ♂ foliis brevior, floribus glomeratis, 4-meris. *Infl.* ♀ foliis longior, ramis paniculatis subsecundis, ramulis divaricatis, pedicellis ¼ unc. longis in laminas flabelliformes connatis. *Fl.* ♀ apici pedicelli oblique impositus. *Perigonii* foliola 2, æqualia, oblique ovata, fructu non accrescentia, achenio dimidio breviora. *Achenium* $\frac{1}{10}$ unc. latum, compressum, suborbiculare, stylo brevi filiformi, marginibus late incrassatis, faciebus planis vix granulatis.

Very nearly allied to the Indian *L. terminalis*, but the inflorescence is lateral; and still more near to the American *L. Canadensis*, but the achenia have much broader wings; it differs further from both in the shorter stigma.

4. ELATOSTEMMA MONTICOLA, *H.f.*, n. sp. 6–8-pollicaris, caule tenui pubescenti-tomentoso, foliis alternis breviter petiolatis oblique obovato-oblongis grosse serrato-dentatis utrinque sparse setulosis, superiore basi acuto, inferiore obtuso, nervis primariis 2–3, stipulis lanceolatis, capitulis ♀ subsessilibus depressis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Herba* tenella. *Folia* 1–1½ unc. longa, membranacea, puberula et setulosa. *Capitula* ♀ ¼–⅓ unc. diametro. *Involucrum* membranaceum, multilobatum, multiflorum, lobis oblongis ciliatis. *Fl.* ♀ sessiles et pedicellati, conferti. *Perianthii* foliola lanceolata, setuloso-ciliata. *Achenium* ellipsoideum.

A very common form of the genus, resembling closely several mountain Indian species.

5. PILEA QUADRIFOLIA, *A. Rich.* Dioica, spithamæa, glaberrima v. sparse pilosula, caule erecto ramoso gracili, foliorum paribus æqualibus graciliter petiolatis ½–⅔ unc. longis late ovatis acutis grosse crenato-serratis membranaceis, stipulis amplis late cordato-rotundatis; fl. ♂ in axillis glomerati, ♀ axillis supremis dense paniculatim conferti.—*Wedd. Monogr. Urt.* 199.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Species elegans, gracilis, læte virens. *Petioli* foliis subæquilongi. *Folia* basi 3-nervia. *Stipulæ* ⅙ unc. longæ. *Fl.* ♂ in axillis plurimis caulis dense congesti, majusculi, 3–5-meri, perianthii lobis 1 v. pluribus longe aristatis. *Fl.* ♀ in paniculas breves subterminales foliis 4 supremis involucratas dense aggregati, perpusilli, breviter pedicellati. *Perianthium* foliolum 1 oblongum (cætera in fructu evanida), achenio brevius. *Achenium* minimum, ovatum, compressum, subgranulatum, stigmate infra-apicali.

The female of this plant (from Abyssinia) is well described by Weddell. The male has long stems and uniform leaves throughout the plant; and the female has much shorter stems, with very few leaves, of which the four upper are subterminal and form a whorl, the lower are (by arrest) smaller, all more or less toothed in our specimens, but apparently sometimes quite entire in Abyssinian. A very closely allied, but larger species, with more effuse female panicles in the axils of all the leaves, is sent by Mann, from 4000 feet in Fernando Po.

6. LEIANTHUS WIGHTII, *Weddell, Monog. Urt.* 280.

*Hab.* Fernando Po, alt. 7500 feet.

Apparently the same as the Indian species, which is also Abyssinian.

7. URERA?

*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Dec.)

A tropical form of *Urticeæ*, of which there are male flowers only.

### 45. PIPERACEÆ.

1. PEPEROMIA MANNII, *H. f.*, n. sp. Glabra, 4–6-pollicaris, caule gracili basi repente, foliis alternis breviter petiolatis ovato-rotundatis obtusis reticulatim nervosis minute ciliolatis, amentis solitariis subterminalibus strictis brevibus gracilibus.

*Hab.* Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)

Species parvula, *caule* gracili, subsimplici. *Folia* ¼–½ unc. longa, fere æque lata v. anguste oblonga, subcarnosa, subtus nigro-punctata, margine apicem versus villosulo. *Amenta* gracilia, breviter pedunculata, ¼–2 unc. longa, minute nigro punctata; squamæ orbiculatæ, peltatæ. *Stamina* 2, brevia, antheris parvis oblongis. *Stigma* globoso-capitatum.

This approaches closely the Indian *P. Heyneana*, but the leaves are always alternate and the whole plant almost perfectly glabrous. The *P. Abyssinica* is a much more robust and fleshy plant.

2. PEPEROMIA MONTICOLA, *H. f.*, n. sp. Glaberrima, spithamæa ad pedalis, caule robusto, foliis alternis petiolatis elliptico-oblongis obtusis basi 3-nerviis carnosis, nervis crassis, amentis pedunculatis elongatis crassiusculis.

*Hab.* Cameroons Mountains, alt. 8000 feet. (Fl. Jan.)

*Caules* basi longe repentes, demum erecti, crassitie pennæ corvinæ. *Folia* 1–1½ unc. longa, elliptico- v. ovato-oblonga, in petiolum ⅓–½ unc. longum attenuata. *Amenta* solitaria, terminalia et axillaria, pedunculata, simplicia, crassitie caulis v. tenuiora, 1–2 unc. longa; squamæ orbiculatæ, peltatæ.

A very common West-Indian type of the genus; also closely allied to *P. Courtallensis* β. of Ceylon (Thwaites's Enum. 292). It differs from *P. Vogeliana* in the obtuse leaves.

3. COCCOBRYON CAPENSE, *Klotzsch.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

A South-African species; also found by Mann on the low ground of Fernando Po (alt. 1300 feet) and in St. Thomas's (alt. 4000–7000 feet). Kirk (Livingstone's Expedition) gathered the same plant at Dzomba, alt. 6500 feet.

### 46. Myriceæ.

1. **Myrica salicifolia**, *Hochst., A. Rich. Fl. Abyss.* ii. 277.

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec., Jan.)

A tree 20–30 feet high, identical with the Abyssinian, which is described as a tall tree with variable foliage, growing in cold mountain districts.

### 47. Coniferæ.

1. **Podocarpus Mannii**, *H. f.*, n. sp. Foliis anguste elongato-lanceolatis 3–5-pollicaribus $\frac{1}{6}$–$\frac{1}{3}$ unc. latis lente falcatis acuminatis mucronatis 1-nerviis utrinque lucidis.

*Hab.* St. Thomas's Island, summit of the Peak, alt. 7500 feet.

*Ramuli* tenues, angulati. *Folia* subdisticha, coriacea, nervo latiusculo, petiolo basi semitorto.

The present discovery of Mr. Mann's negatives the observation of Brown, that Coniferous plants are absent in Western tropical Africa; and I may here remark that this indefatigable collector has also added *Laurineæ* to the same flora, an order equally supposed by Brown to be absent in that region of the globe. The present plant approaches so closely to the South-African *Podocarpus falcatus*, Br., that I should not be surprised if it merged into it; but the leaves are much larger, longer, flaccid, and lucid, and there are stomata on both surfaces of the leaf, which (according to Endlicher, Syn. Conif. 218) is not the case with *P. falcatus*. From the Cape *P. elongatus*, Hérit., which small-leaved specimens closely resemble, it differs in the lucid, very large, long, and acuminate leaves.

There is another species of *Podocarpus* in Abyssinia, referred to *P. elongatus* by A. Richard (Fl. Abyss. ii. 278), which is identical in foliage with the Cape plant, but which differs in the fruit being shortly stipitate.

## Monocotyledones.

### 48. Orchideæ.

1. **Liparis Capensis**, *Lindl.* (*Zeyher*, 3887).

*Hab.* Cameroons Mountains, alt. 6000–7000 feet. (Frt. Dec.)

A small species, in fruit only, but clearly the same as *L. Capensis*.

2. **Bolbophyllum (Ptiloglossum) tenuicaule**, *Lindl. in Journ. Linn. Soc.* vi. 126.

*Hab.* Fernando Po, alt. 5000 feet.

3. **Bolbophyllum (Ptiloglossum) Mannii**, *H. f.* Pseudobulbis teretiusculis elongatis 2-phyllis, foliis 4–6-pollicaribus linearibus, bracteis glumaceis distichis imbricatis, sepalis lanceolato-subulatis,

petalis parvis linearibus labello lineari-oblongo sepalis subæquilongo longe ciliato.

*Hab.* Cameroons Mountains, alt. 4000–5000 feet. (Fl. Dec.)

*Caudex* repens. *Pseudobulbi* 3–5 unc. longi, basi $\frac{1}{2}$ unc. lati. *Folia* $\frac{1}{2}$–$\frac{3}{4}$ unc. lata, obtusiuscula. *Scapus* 1–1$\frac{1}{2}$-pedalis, gracilis, erectus, strictus, spathaceo-bracteatus. *Racemus* 4–6-pollicaris. *Bracteæ* oblongæ, acutæ, concavæ, $\frac{1}{3}$ unc. longæ. *Flores* labello excepto glaberrimæ, bracteis paulo breviores. *Labellum* brevissime unguiculatum. *Columnæ* ramis longe setaceis.

4. Bolbophyllum (Ptiloglossum) monticolum, *H. f.*, n. sp. Pseudobulbis oblongis pollicaribus tetragonis 2-phyllis, foliis 2–3-poll. linearibus, bracteis glumaceis distichis imbricatis, sepalis subulato-lanceolatis, labello lineari-oblongo v. subspathulato longe ciliato sepalis subæquilongo.

*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Nov.)

*Caudex* repens. *Pseudobulbi* verisimiliter tetrapteri. *Folia* $_{7}$ unc. longa. *Scapus* foliis duplo longior, spathaceo-bracteatus. *Racemus* 1$\frac{1}{2}$-poll. *Bracteæ* ovato-oblongæ, acutæ, $\frac{1}{4}$ unc. longæ. *Flores* flavi?, bracteis paulo breviores, iis *B. Mannii* valde similes, sed minores, labello a basi sensim lente dilatato, petalisque paulo latioribus.

5. Bolbophyllum (Monophylla) aurantiacum, *H. f.*, n. sp. Caudice valido, pseudobulbis brevibus late ovoideis 1-phyllis, folio lineari basi in petiolum teretem complicato, racemo elongato nutante, floribus aurantiacis secundis, bracteis lanceolatis membranaceis ovarium excedentibus, sepalis longe lanceolato-subulatis, petalis oblongis sepalis dimidio brevioribus, labello elongato-trulliformi recurvo glaberrimo petalis paulo longiore.

*Hab.* Cameroons Mountains, alt. 5000–6000 feet. (Fl. Nov.)

*Caudex* crassitie pennæ anatinæ. *Pseudobulbi* 1 unc. longi, ovoidei, basi plus minus tumidi, obtusi. *Folium* 4–5 poll. long., $\frac{1}{2}$–$\frac{3}{4}$ lat., obtusum. *Scapus* gracilis, spathaceo-bracteatus. *Racemi* 5–6-pollicares, multiflori. *Flores* fere $\frac{1}{2}$ unc. longi. *Bracteæ* membranaceæ. *Sepala* a basi sensim angustata, longe acuminata. *Labellum* oblongo-lanceolatum, longiuscule stipitatum, eglandulosum, superficie lævi, medio anguste sulcatum. *Columnæ* rami breves, subulati.

6. Bolbophyllum (Diphylla) bifarium, *H. f.*, n. sp. Caudice valido, pseudobulbis elongato-ovoideis pollicaribus tetrapteris 2-phyllis, foliis lineari-oblongis 3-pollicaribus, scapi bracteis imbricatis, racemo disticho, bracteis ovato-lanceolatis acuminatis patentibus flores excedentibus, sepalis e basi ovato-subulatis membranaceis, lateralibus deflexis, petalis parvis late oblongis undulatis, labello minimo crasso recurvo medio excavato apice truncato glanduloso.

*Hab.* Cameroons Mountains, alt. 5000 feet. (Fl. Nov.)

*Caudex* crassitie pennæ corvinæ. *Folia* sessilia, ⅓ unc. lata. *Scapus* brevis, bracteis compressis distiche imbricatis acutis tectus. *Racemus* 3–4-pollicaris, rhachi valida angulata. *Bracteæ* fere ½ unc. longæ, membranaceo-glumaceæ. *Flores* purpurei?, glaberrimi. *Sepalum* superius cucullatum, lateralia planiuscula. *Petala* membranacea. *Labellum* crasse carnosum, columna brevius, brevissime unguiculatum, basi latiusculum, in apicem crassum truncatum attenuatum. *Columna* alata, alis in processus 2 breves subulato-productis.

7. BOLBOPHYLLUM, sp.?
*Hab.* Cameroons Mountains, alt. 5000 feet. (Fruit only.)
Species parvula, *caudice* valido. *Pseudobulbi* breves, oblongi, tetrapteri, 2-phylli. *Folia* 1½ unc. longa, lineari-oblonga, in petiolum contracta. *Scapus* brevis, validus. *Racemus* rhachi compressa v. angulata, robusta. *Bracteæ* parvæ. *Flores* parvi. *Sepala* ovato-subulata. *Petala* parva, linearia. *Labellum* crasse carnosum, recurvum, obtusum, excavatum. *Columna* aptera, ramis 2 subulatis porrectis.

8. ANGRÆCUM ARCUATUM, *Lindl.*
*Hab.* Cameroons Mountains, alt. 4000–6000 feet. (Fl. Nov.)

The same as the Cape of Good Hope species, which ranges from Uitenhage to Natal. Lindley identifies a much larger form, gathered by Mann on the banks of the Nun, with the same.

9. ANGRÆCUM, sp.
*Hab.* Cameroons Mountains, alt. 5000 feet. (Fruit only.)

Very similar to, but much smaller than, *A. capitatum*, Lindl. (*ante*, vi. 137).

10. POLYSTACHYA ALPINA, *Lindl.* (*ante*, vi. 131).
*Hab.* Fernando Po, alt. 6000 feet. (Fl. Dec.)

11–15. POLYSTACHYÆ species 5.
*Hab.* Cameroons Mountains, alt. 5000–6000 feet.

Of this genus, which abounds in tropical Africa, and of which one species reaches the Albany district of South Africa, there are five Cameroons Mountains species, occurring at elevations between 4000 and 6000 feet.

16. CALANTHE CORYMBOSA, *Lindl.* (*ante*, vi. 129).
*Hab.* Fernando Po, alt. 5000 feet. (Fl. Dec.)

17. DISA ALPINA, *H.f.*, n. sp. Caule gracili, foliis elongato-lanceolatis longe acuminatis 3-nerviis, spica densiflora, bracteis subulato-lanceolatis flores subæquantibus, sepalo postico late ovato obtuso calcari decurvo æquilongo, petalis late oblique ovatis obtusis, labello minimo lineari.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)
*Herba* gracilis, spithamæa ad pedalis, glaberrima. *Folia* caule paulo

breviora, $\frac{1}{6}$–$\frac{1}{2}$ unc. lata, subcoriacea, plana. *Spica* 2–3 unc. longa. *Sepala* et *petala* $\frac{1}{8}$ unc. longa, flava? *Columna* basi latiuscula, glandulosa.

18. Peristylus (Bifolii) tridentatus, *H.f.*, n. sp. Parvulus, foliis 2 orbicularibus ciliatis, scapo aphyllo villoso 3–4-floro, bracteis parvis subulatis, ovario retrorsum piloso, sepalis petalisque apice 3-dentatis, labello amplo dilatato 7-lobo villoso, calcari brevi conico acuto.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

*Herba* 3-pollicaris. *Folia* coriacea, subacuta, ut videtur cellulosa. *Scapus* robustus. *Flores* parvi. *Sepala* et *petala* subæqualia, pubescentia, $\frac{1}{10}$ unc. longa. *Labellum* sepalis longius, disco villoso utrinque lobulo aucto, apicem versus dilatatum 5-lobum, lobis ovatis. *Columna* brevis.

19. Habenaria debilis, *H.f.*, n. sp. Parvula, caule ovariisque glanduloso-pilosis, foliis 1 et 2 lanceolatis acuminatis, racemo 3–10-floro, bracteis ovario brevioribus, floribus parvis, sepalis petalisque late ovato-oblongis obtusis labello petalis subæquilongo 3-lobo, lobis lineari-oblongis obtusis, antheræ loculis contiguis, calcari recto ovario breviore.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Caulis* 4–6-pollicaris, gracilis. *Folia* caule paulo breviora, plana, acuminata, in petiolum angustata. *Racemus* pauci- v. multiflorus. *Ovarium* subsessile, apice vix constricto. *Bracteæ* setaceo-lanceolatæ. *Perianthium* $\frac{1}{10}$ unc. latum, foliolis obtusiusculis. *Columnæ* processus breves, ascendentes, apice glandulosi.

20. Habenaria attenuata, *H.f.*, n. sp. Glaberrima, caule gracili pedali bracteato, foliis ad 2 lineari-lanceolatis, racemo elongato, floribus distantibus, bracteis ovario longioribus attenuato-acuminatis, sepalis petalisque ovato-oblongis obtusis, labello 3-partito lobis linearibus, calcari gracillimo ascendente ovario longiore, antheræ loculis contiguis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

*Caulis* tenuis. *Folia* 2–5 unc. longa, $\frac{1}{3}$–$\frac{3}{4}$ lata, acuta, plana, non petiolata. *Bracteæ caulinæ* vaginantes, longe acuminatæ. *Racemus* 3–5-pollicaris. *Flores* laxi. *Ovarium* apice contractum. *Perianthium* $\frac{1}{6}$ unc. latum. *Labelli* lobi lineares, obtusi, petalis æquilongi. *Calcar* $\frac{1}{3}$–$\frac{1}{2}$ unc. longum, attenuatum. *Columnæ* processus breves, crassi, porrecti.

Very near the Abyssinian *H. bracteosa*, A. Rich., but the flowers are much smaller and the leaves narrower.

21. Habenaria microceras, *H.f.*, n. sp. Glaberrima, 1–2-pedalis, caule folioso basi vaginato, foliis oblongis utrinque acutis 7–9-nerviis, racemo elongato densifloro, bracteis ovario brevioribus, floribus minutis, sepalis petalisque late oblongis obtusis, labello brevi 3-fido, calcari tumido obtuso æquilongo, antheris contiguis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

Exemplar solitarium. *Caulis* robustus, per totam longitudinem foliosus. *Folia* 5–6, 3–4 unc. longa, 2–3 lata, membranacea, non petiolata. *Racemus* post anthesin fere pedalis, floribus imbricatis. *Bracteæ* subulato-lanceolatæ. *Ovarium* apice contractum. *Perianthium* $\frac{1}{10}$ unc. latum. *Labellum* late oblongum, lobis brevibus obtusiusculis. *Columnæ* processus breves, crassi, obtusi, divergentes.

Habit of *H. prœalta*, but leaves much broader and flowers smaller.

22. HABENARIA PRÆALTA, *Lindl. Gen. et Sp. Orch.* 321, *et ante*, vi. 140.

*Hab.* Fernando Po, alt. 10,000 feet. (Fl. Dec.)

Also a native of Bourbon, if the same; but the Fernando Po plant has the spur much longer than the ovary and not at all clavate.

23. HABENARIA MANNII, *H. f.*, n. sp. Glaberrima, spithamæa, caule folioso basi vaginato, foliis lineari-lanceolatis acuminatis recurvis, bracteis late ovatis acuminatis ovario longioribus, floribus paucis amplis, sepalis falcato-ovatis acuminatis, petalis linearibus obtusis, labello angusto 3-partito, calcari æquilongo, lobis anguste linearibus, exterioribus multifidis, columna brevissima 2-cruri, antheris distantibus cruribus insertis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Nov.)

*Caulis* erectus, strictus, foliosus. *Folia* complicata, 3-nervia, 3–5-pollicaria, in bracteas floriferas abeuntia. *Bracteæ* concavæ, $\frac{3}{4}$ unc. longæ. *Flores* 1 unc. lati. *Sepala* 3-nervia, subcoriacea, patentia. *Labelli* lobi angustissimi. *Calcar* incurvum, $\frac{1}{3}$ unc. longum, sensim inflatum, obtusum. *Columna* (valde singularis) brevissima, in ramos 2 divaricatos et porrectos fissa, ramis cum processibus columnæ apice oblique truncatæ continuis. *Antheræ* loculi longe distantes, caudiculis erectis.

A most remarkable plant, very closely allied to three Abyssinian species, *H. Quartiniana*, *macrantha*, and *decorata*, in all of which the column is split to the base into two projecting arms, and the anther-lobes placed wide apart, one on each arm, with their caudicles turned up at right angles.

## 49. IRIDEÆ.

1. TRICHONEMA BULBOCODIUM, *Ker.*

*Hab.* Cameroons Mountains, alt. 7000–9000 feet. (Fl. Nov.)

A small-flowered form, in no way differing from the Abyssinian. The species is found from the Channel Islands to the Canaries and Azores, and throughout the Mediterranean region, Algeria, Asia Minor, Syria, and at Socotra in the Red Sea.

2. GEISSORHIZA ALPINA, *H. f.*, n. sp. Caule compresso 4–10-pollicari, 2–3-floro, foliis anguste lineari-elongatis 4–6-pollicaribus, bracteis ovato-oblongis acutis ovarium excedentibus capsulam æquantibus, perianthii limbo subobliquo laciniis oblongis obtusis.'

*Hab.* Cameroons Mountains, alt. 9000–10,000 feet. (Fl. Nov.)

*Herba* gracilis, glaberrima. *Folia* stricta v. lente curva, $\frac{1}{10}$ unc. lata, costa valida. *Caulis* strictus v. parum flexuosus, foliis 2–3 spathaceis auctus. *Bracteæ* exteriores $\frac{1}{2}$ unc. longæ, strictæ, virides, marginibus membranaceis, interiores breviores, obtusæ, hyalinæ. *Flores* $\frac{3}{4}$ unc. longæ, ut videtur ex sicco pallide purpureæ. *Antheræ* parvæ. *Capsula* $\frac{1}{2}$ unc. longa, cylindrico-trigona, utrinque obtusa, membranacea, polysperma. *Semina* in quovis loculo ad 12, globosa, majuscula.

This resembles a good deal the *G. Abyssinica*, but is a more slender plant, with much fewer flowers, apparently of a very pale colour; the anthers, too, are smaller and straighter. It most resembles the South-African *G. juncea*.

### 50. HYPOXIDEÆ.

1. HYPOXIS VILLOSA, *L.*, var. foliis recurvis.

*Hab.* Cameroons Mountains, alt. 7000–7500 feet. (Fl. Nov.)

Apparently the same with the Cape, East-African, and Abyssinian species, but the leaves are rather more rigid and always recurved.

### 51. MELANTHACEÆ.

1. MELANTHIUM TENUE, *H. f.*, n. sp. 3–4-pollicare, caule tenui subunifolio 2-floro, folio anguste lineari caule longiore, perianthii foliolis lineari-oblongis obtusis medio purpureis basi vix saccatis, ovarii lobis in stylos rectos subulatos discretos sensim attenuatis.

*Hab.* Fernando Po, alt. 9000 feet. (Fl. April, May.)

Species parvula, facie omnino *Anguillariæ dioicæ*. *Bulbi* tunica lævis, papyracea, castanea. *Caulis* curvus v. subflexuosus, tenuis, basi vaginatus, supra basin 1-foliatus, et superne bractea basi tumida spathacea apice longe lineari auctus. *Folium* vix $\frac{1}{12}$ unc. latum, rigidum, enerve, concavum. *Flores* $\frac{1}{3}$ unc. diametro, albi, purpureo maculati.

A very distinct little species, of a peculiarly Cape genus, not hitherto found in Abyssinia.

### 52. COMMELYNEÆ.

1. COMMELYNA, sp.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.) (Fruit only.)

*Caulis* tenuis, decumbens, linea pilorum auctus. *Folia* brevia, 1–1$\frac{1}{2}$ unc. longa, ovato-oblonga v. oblongo-rotundata, glabra, margine incrassato ciliato. *Vagina* tenuis, membranacea, marginibus longe villosis. *Spatha* breviter pedunculata, complicata, explicata latissime cordata, acuta, glaberrima, ciliolata, 2-flora.

Also an Abyssinian and Madagascar plant, very near *C. Forskahlii*, if not the same; but in the present condition of the genus *Commelyna* it is hopeless to identify a species in all its forms without a study of the whole.

2. CYANOTIS ABYSSINICA, *A. Rich.* (*ante*, vi. 21).
*Hab.* Fernando Po, alt. 9000 feet. Cameroons Mountains, alt. 7000–9000 feet. (Fl. Nov., Dec.)

Certainly the same as the Abyssinian plant, of which the tubers are eaten, and probably the same also with a Madagascar and S.-African one.

### 53. JUNCEÆ.

1. JUNCUS CAPITATUS, *Weig.*; *Kunth, Enum. Plant.* iii. 347.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Identical with the European plant, except that the glumes are rather longer and more membranous; in form they do not differ, any more than the capsules and seeds. The Cameroons specimens are triandrous. This minute species is a native of Europe, from Norway to Spain, Madeira, and the Canary Islands, and from the Azores to Greece and Middle Russia; it has not been found in Abyssinia.

2. LUZULA CAMPESTRIS, *L.* (*ante*, vi. 22), var. *congesta*.
*Hab.* Fernando Po, alt. 8500–10,500 feet. Cameroons Mountains, alt. 10,000 feet. (Fl. Dec.)

Apparently identical with the European plant. The flowers are of a very dark colour. This form has not been detected in Abyssinia; but the South-African *L. Africana*, Drège, is referred to this variety by E. Meyer (Herb. Hook.).

### 54. CYPERACEÆ.

1. CYPERUS ELEGANTULUS, *Steud. Pl. Schimp.* sect. ii. no. 574.
*Hab.* Fernando Po, alt. 8500 feet.

This Abyssinian species is united by A. Richard with *C. atronitens*, Hochst., and perhaps rightly, but the scales are much larger and rather longer in outline.

2. CYPERUS INGRATUS, *Kunth, Enum.* ii. 31.
*Hab.* Fernando Po, alt. 6000–7000 feet. Cameroons Mountains, alt. 6000–7000 feet. (Fl. Dec.–April.)

I am unable to identify this species with any but the Cape of Good Hope *C. ingratus*; it varies greatly in size, the larger specimens resembling the Abyssinian *C. derreilema*, Steud., and the smaller some states of *C. bulbosus*; but the acute glumes distinguish it from both. The small, white, smooth, triquetrous achenium is very characteristic of the Cape and Cameroons Mountains plants.

3. Cyperus Adoensis, *Hochst.; A. Rich. Fl. Abyss.* ii. 484.
*Hab.* Fernando Po, alt. 8500 feet. (Fl. April.)

The scales, described by A. Richard as being rarely mucronate in the Abyssinian plant, are always so in the Fernando Po specimens.

4. Kyllingia macrocephala, *A. Rich. Fl. Abyss.* ii. 490.
*Hab.* Fernando Po, alt. 7000–8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Nov.–April.)

Identical with the Abyssinian plant.

5. Isolepis capillaris, *Rœm. & Sch.; Kunth, Enum.* ii. 211. I. trifida, *Nees; Kunth, Enum.* ii. 213.
*Hab.* Fernando Po, alt. 8500–10,700 feet. Cameroons Mountains, alt. 6000–10,000 feet. (Fl. Nov.–April.)

A common tropical plant, found at various elevations, in America, Africa, and India, but not in South or North Africa. The *I. tenerrima*, Fisch., of South Russia is the same plant, I think.

6. Isolepis schœnoides, *Kunth, Enum.* ii. 209. Schœnus erraticus, *H.f.* (*ante*, vi. 22).
*Hab.* Fernando Po, alt. 8500–9000 feet. Cameroons Mountains, alt. 7000–9000 feet. (Fl. Nov.–April.)

This appears to me to be much nearer allied to *Schœnus* than to *Isolepis*. It is a native of mountain marshes in the eastern parts of the Cape Colony.

7. Carex cruciata*, *Nees?; Boott, Illustr. Carex*, t. 319. Foliis firmis.
*Hab.* St. Thomas's, summit of the Peak, alt. 7500 feet.

The original *C. cruciata* is a native of the Himalaya and Khasya ranges.

8. Carex Wahlenbergiana, *Boott, Illustr. Carex*, t. 301 (*ante*, vi. 22).
*Hab.* Fernando Po, alt. 8000 feet. (Fl. Dec.)

A native of Bourbon, the Mauritius, and mountains of Abyssinia, at an elevation of 9000–10,000 feet.

9. Carex Boryana, *Schk.* (*ante*, vi. 22).
*Hab.* Fernando Po, alt. 7500–8500 feet. (Fl. Dec.)

A native of Bourbon and the Mauritius.

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* The Carices have all been named by the late Dr. Boott, F.L.S.

10. Carex Æthiopica, *Schk.*; *Boott, Illustr. Carex*, t. 341–344.
*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec.)

Also a native of Abyssinia and South Africa.

11. Carex echinochloe, *Kunth*; *Boott, Illustr. Carex*, t. 166.
*Hab.* Cameroons Mountains, alt. 7000 feet.

Also a native of Abyssinia, alt. 6000 feet, and probably not different from *C. Wahlenbergiana*.

## 55. GRAMINEÆ.

1. Panicum (Miliaria) Hochstetteri, *Steud. Syn. Gram.* 90. P. trichanthum, *A. Rich.*, non *Nees*.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Apparently a native of Abyssinia in mountain regions.

2. Panicum (Virgaria) acrotrichum, *H.f.*, n. sp. Debile, culmis gracilibus, vaginis foliisque ciliatis, foliis brevibus lanceolatis longe acuminatis planis longe pilosis, nervis 7–9, panicula laxa erecta, spiculis parvis apice setulis strictis valvulis acutis æquilongis terminatis.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)
*Gramen* elegans, culmis 2–3-pedalibus foliosis lævibus, nodis glaberrimis. *Vaginæ* tenues, 2–3-pollicares, glaberrimæ v. pilosulæ, marginibus superne ciliatis, ore lanuginoso. *Folia* 2–4 poll. longa, $\frac{1}{3}$–$\frac{2}{3}$ lata, plana, membranacea, ciliata, paginis pilis pallidis elongatis rigidis sparsa. *Panicula* effusa, laxa, 4–8-uncialis, ramis geminis apices versus divisis rhachique subflexuosa filiformibus lævibus. *Spiculæ* parvæ, pallidæ, $\frac{1}{12}$ unc. longæ; valvulæ 5, exterior longitudine valde variabilis, quam secunda brevior, oblongo-lanceolata, obtusa, nuda v. setulis 1–2 aucta; secunda ovato-lanceolata, acuminata, viridis, 7-costata, apicem versus setosa, setis 2–3 terminalibus valvulam æquantibus; tertia secundæ subsimilis sed nuda; 2 intimæ cymbiformes, obtusæ, coriaceæ, albidæ, lævissimæ.

A delicate grass, easily recognized by the 2–3 long bristles at the apex of the second valve of the spikelet. It is more allied in habit and other characters to the Cape *P. æquinerve*, Nees, than to any species known to me, though that plant is placed in the section *Virgatæ*.

3. Panicum (Virgaria) monticolum, *H.f.*, n. sp. Debile, culmis gracilibus, vaginis foliisque glabriusculis, foliis brevibus lanceolatis acuminatis planis striatis obscure 7-nerviis, panicula laxa pauciflora erecta, spiculis parvis oblongis obtusis glaberrimis.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Feb.)
*Gramen* elegans, culmis basi prostratis ramosis sulcatis demum ascendentibus 1–2-pedalibus foliosis lævibus, nodis glaberrimis. *Vaginæ* tenues, 1–2 unc. longæ, superne setulis curvis rigidis ciliatæ; ore glabro.

*Folia* 1½–2 unc. longa, ¼–½ lata, plana, membranacea, viridia, marginibus non ciliatis, nervis primariis ad 7 a secundariis perplurimis vix distincta, nervulis paucis transversis trabeculatis, paginis lævibus. *Panicula* 2–3-pollicaris, laxa, ramis solitariis ½–1-pollicaribus apices versus 1–2-floris; rhachi ramisque filiformibus lævibus. *Spiculæ* pedicellatæ, $\frac{1}{12}$ unc. longæ, glaberrimæ. *Valvula* exterior brevis, late ovata, apice rotundata; secunda et tertia consimiles, concavæ, oblongæ, obtusæ, læves, 5-nerves; 2 intimæ cymbiformes, coriaceæ, obtusæ, læves.

Similar in habit, &c. to *P. acrotrichum*, but at once distinguished by the glabrous leaves, fewer-flowered panicle, its solitary branches, and the glabrous, blunt, 5-nerved glumes, which are not ribbed.

4. PANICUM (MILIARIA) PUSILLUM, *H. f.*, n. sp. Molliter laxe villosum, parvulum, debile, culmis decumbentibus filiformibus foliosis, foliis parvis lanceolatis, panicula laxa ovata ramosa, ramis deflexis 3–4-floris, ramis ramulisque flexuosis, valvulis 3 spiculæ costatis longe setosis.

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)

Debile, annuum, pusillum, totum pilis mollibus patentibus elongatis laxe villosulum, culmis decumbentibus laxe foliosis fere capillaribus 2–3-pollicaribus, nodis non barbatis. *Vaginæ* ⅛ unc. longæ, laxæ, costatæ. *Folia* ¼–⅓ unc. longa, anguste lanceolata, acuminata, plana, multicostata, utrinque villosula. *Panicula* pollicaris, erecta, ramis solitariis brevibus capillaribus. *Spiculæ* vix $\frac{1}{12}$ unc. longæ. *Valvulæ* 3 exteriores subæquales, membranaceæ, virides, ovatæ, acutæ, longe pilosæ, pilis basi tuberculatis; exterior 3-costata, paulo minor; 2 sequentes 5-costatæ, costis acutis; 2 intimæ cymbiformes, coriaceæ, glaberrimæ, læves, subacutæ.

A very remarkable little species, quite unlike any with which I am acquainted; its habit is that of *Isachne dispar*.

5. ISACHNE REFRACTA, *H. f.*, n. sp. Fere glaberrima, culmis basi geniculatis decumbentibus demum erectis gracilibus strictis lævibus, vaginis lævibus sulcatis versus margines pilosulis, foliis refractis anguste lanceolatis longe acuminatis strictis scabrulis marginibus incurvis, panicula effusa, ramis strictis hic illic longe pilosis, valvulis ovatis subacutis valide costatis.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Gramen* rigidulum, perenne, 3-unc. ad pedale, culmis cæspitosis basi decumbentibus ramosis. *Folia* stricta, ½–2 unc. longa, omnia deflexa. *Culmi* superne gracillimi, lævissimi. *Panicula* 1–3-pollicaris, late ovata, fere æque lata, ramis alternis capillaribus flexuosis ramulis 1–4-floribus. *Spiculæ* pedicellatæ, $\frac{1}{12}$ unc. longæ, purpureæ, ovatæ, subacutæ. *Valvulæ* glabræ, exterior minor ovato-oblonga acuta 3-costata, 2 sequentes subæquales 5-costatæ; flosculus inferior (interdum neuter v. imperfectus) membranaceus; hermaphroditus 2-paleaceus, valvulis oblongis obtusis cymbiformibus coriaceis lævibus.

The refracted leaves and costate subacute glumes at once distinguish this remarkable species.

6. **Pennisetum (Gymnothrix) riparioides**, *Hochst.*?; *A. Rich. Fl. Abyss.* ii. 383.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec., Jan.)

The rachis and apex of the culm are more villous than in the Abyssinian specimen, but the plants are otherwise very similar; the whole genus, however, requires revision before the limits of this or any other species can be established. The spikelets are sometimes very lax and few, at others dense; the setæ are about as long as the glumes, and vary greatly in number.

7. **Vilfa montana**, *H.f.*, n. sp. Glaberrima, lævis, spithamæa ad pedalis, culmis cæspitosis simplicibus gracilibus erectis, foliis radicalibus curvis elongato-subulatis marginibus involutis scabrulis, panicula laxa ovata, ramis paucis verticillatis capillaribus apices versus 2–3-floris, spiculis glaberrimis nitidis, gluma inferiore superiore lanceolato acuminato ½ breviore, flosculo gluma superiore breviore.
*Hab.* Cameroons Mountains, alt. 7000–9000 feet. (Fl. Dec.)
*Gramen* elegans, perenne. *Folia* radicalia 1½–2 unc. longa, vix $\frac{1}{12}$ unc. lata, rigidula, patenti-recurva, e vagina brevissima sensim subulato-attenuata, sulcata. *Culmus* gracillimus, 1–2-foliatus, vaginis elongatis tenuibus sulcatis, ligula 0. *Panicula* 2 unc. longa, verticillis ad 6, rhachi ramisque capillaribus, infimis deflexis. *Spiculæ* ⅛ unc. longæ, fuscæ, nitidæ. *Gluma* inferior obtusiuscula, superior acuta.

A beautiful small grass, almost identical in the inflorescence, and size, structure, and colour of the spikelets, with the S.-African *V. centrifuga*, Nees; but the branchlets are only in threes, the leaves infinitely narrower, and the whole plant very slender: the two grasses are, however, most closely allied.

8. **Deyeuxia Mannii**, *H.f.*, n. sp. Culmis elongatis gracillimis foliosis 2–3-pedalibus, vaginis sulcatis scabrulis, foliis strictis anguste lineari-lanceolatis, ligulis elongatis fissis, panicula elongata effusa multiflora rhamis rachique capillaribus, glumis lanceolato-subulatis glabris enerviis carina scabrida, palea inferiore villosa apice breviter 4-setosa arista basilari palea subduplo longiore, superiore æquilonga apice 2-setosa basi villosa et setula villosa aucta.
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 8000–13,000 feet. (Fl. Dec.–May.)
*Gramen* gracile, culmis fastigiatis, parce ramosis. *Folia* 6 unc. longa,

$\frac{1}{8}$ unc. lata, stricta, plana v. involuta, minute scabrula. *Panicula* 3–4 unc. longa, erecta v. inclinata, ramis ramulisque capillaribus. *Spiculæ* pallide purpureæ, nitidæ, $\frac{1}{6}$–$\frac{1}{4}$ unc. longæ, arista capillari.

The only species of the genus hitherto found in tropical or South Africa.

9. Microchloa setacea, *Br.*; *Steud. Syn. Gram.* 202.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

Specimens very small and annual, possibly seedlings only; the flowers, &c., are identical with those of the Indian plant, which is found also in Australia, Abyssinia, S. Africa, S. America, and the plains of the Niger valley.

10. Deschampsia cæspitosa, *Pal. Beauv.*, et var. *latifolia* (*ante*, vi. 23). D. latifolia, *Hochst.*; *A. Rich. Flor. Abyss.* ii. 413.
*Hab.* Fernando Po, alt. 9000–10,000 feet. Cameroons Mountains, alt. 10,000–12,000 feet. (Fl. Dec., Jan.)

11. Aira caryophyllea, *Linn.*
*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec., Jan.)

Also a native of Abyssinia and S. Africa.

12. Aira pictigluma, *Steud. Syn. Gram.* 221.
*Hab.* Cameroons Mountains, alt. 9000–13,500 feet. (Fl. Dec., Jan.)

Also a native of Abyssinia.

13. Avena lachnantha. Trisetum lachnanthum, *Hochst.* (*ante*, vi. 23).
*Hab.* Fernando Po, alt. 8000–9000 feet. Cameroons Mountains, alt. 7000–9000 feet. (Fl. Dec., Jan.)

This, having a hairy ovary, should, according to Steudel, be transferred to *Avena*. The villose character of the lower palea is variable. Also a native of Abyssinia.

14. Avena Neesii. Trisetum, *Hochst.*; *Steud. Syn. Gram.* 227.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec., Jan.)

This also is an Abyssinian plant. The spikelets vary in size and colour; the lateral laciniæ of the lower palea are sometimes aristate, at others simply acuminate. Sheaths of the lower leaves glabrous, or a little hairy. Ovary villose.

15. Loudetia elegans, *Hochst.*; *Steud. Syn. Gram.* 238.
*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

A native of the mountains of Abyssinia.

16. Danthonia streblochæta, *Steud. Syn. Gram.* 245.
*Hab.* Cameroons Mountains, alt. 8000 feet. (Fl. Dec.)

These specimens of this very remarkable grass agree entirely with the Abyssinian. It differs from the generic character of *Danthonia* in the flowers much exceeding the glumes. The habit of the plant is that of *Festuca gigantea,* which it further closely resembles in colour, stature, and texture.

17. Poa nemoralis, *L.*
*Hab.* Fernando Po, alt. 7500 feet. Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec.–April.)

Not hitherto found in Abyssinia. There are two forms in the Cameroons Mountains: one like the ordinary European; the other, from a lower elevation, of greater size, with more effuse panicles, the branches usually solitary, elongated, and spreading.

18. Kœleria cristata, *Pers.* K. convoluta, *Hochst.; Steud. Syn. Gram.* 293.
*Hab.* Cameroons Mountains, alt. 8000–12,000 feet. (Fl. Dec., Jan.)

A South-African and Abyssinian plant.

19. Festuca bromoides, *Linn.*
*Hab.* Cameroons Mountains, alt. 7000–10,000 feet. (Fl. Dec.)

Common in Abyssinia and South Africa.

20. Festuca Simensis, *Hochst.; Steud. Syn. Gram.* 314.
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 7000 feet. (Fl. Dec.–March.)

21. Festuca gigantea, *Vill.*
*Hab.* Fernando Po, alt. 8500 feet. (Fl. March.)

A larger-flowered form than the European, with larger florets; but I can find no distinctive characters. The ovary is glabrous, with terminal stigma.

22. Festuca Schimperiana, *A. Rich.* (*ante,* vi. 23). F. restituta, *Steud. Syn. Gram.* 314.
*Hab.* Fernando Po, alt. 8500 feet. Cameroons Mountains, alt. 8000–13,500 feet. (Fl. Dec.–March.)

Varies extremely in stature, and in the inflorescence either dense or lax.

23. Tripogon major, *H.f.*, n. sp. Glaberrimus, foliis setaceo-involutis, spiculis ½-poll. 8–12-floris, glumis lanceolato-subulatis acuminatis, rhachi sericeo-villosa, palea inferiore tridentata breviter aristata.
*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)
*Gramen* cæspitosum, strictum, pedale et ultra. *Folia* 4–6-pollicaria, angustissima, strictiuscula, glaberrima v. pilis paucissimis conspersa,

ligula 0. *Culmus* lævis. *Spica* 4–6 unc. longa. *Spiculæ* remotæ, compressæ. *Glumæ* juniores integerrimæ v. obscure 3-dentatæ, demum apice erosæ, exterior rhachi oblique inserta. *Palea* inferior apice minute 3-dentata, arista brevi recta terminata, basi sericeo-barbata, cæterum glaberrima, 3-nervis; superior apice truncata, marginibus ciliolatis. *Ovarium* lineare, glaberrimum, stylis terminalibus divaricatis, stigmatibus brevibus plumosis.

Much the largest species hitherto discovered. The genus is an Indian, Senegambian, and Abyssinian one, but is not hitherto known in South Africa.

24. BROMUS SCABRIDUS, *H. f.*, n. sp. Elatus, gracilis, culmis scabridis, vaginis retrorsum pilosis et scabridis, foliis elongatis planis utrinque scabridis supra pilosis, panicula laxa ampla, ramis oppositis v. ternis 1–4-floris pedicellisque capillaribus et scabridis, spiculis amplis 6–8-floris, palea superiore valide 5-nervia pilosa et scabrula, arista terminali palea breviore recta.

*Hab.* Cameroons Mountains, alt. 7000–8000 feet. (Fl. Dec.)

*Culmi* 3–4-pedales, tenues, striati. *Vaginæ* graciles, sulcati, 6–8-pollicares, ligula brevi lacera. *Folia* caulina 4–6 unc. longa, ⅛ lata, viridia, striata. *Panicula* erecta, pedalis, internodiis 4–5 distantibus, ramulis patentibus flexuosis 3–4-pollicaribus. *Spiculæ* pollicares, ⅓ unc. latæ, virides, nervosæ, flosculis compressis. *Glumæ* aristato-acuminatæ, scabridæ. *Palea* inferior ½-pollicaris, scabrida et pilosa, marginibus pectinato-ciliatis, arista fere terminali ¼ unc. longa. *Ovarium* apice villosum, stylis lateralibus.

A very handsome grass, nearly allied to *B. asper*, but more scabrid, with far larger and more strongly nerved compressed spikelets. It is also very nearly allied to the *B. cognatus*, Steud., of Abyssinia and *B. pectinatus*, Thunb., of South Africa.

25. BRACHYPODIUM SYLVATICUM, *R. & S.* (*ante*, vi. 23).

*Hab.* Fernando Po, alt. 7000 feet.

This is an Abyssinian plant (*B. flexum*, Nees), and also found in South Africa, India, and tropical America.

26. ANDROPOGON (GYMNANDROPOGON) DISTACHYUS, *L.*

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

A native of South Europe and North Africa, as well as of Abyssinia. (*A. polyatherus*, Hochst.)

27. ANDROPOGON (GYMNANDROPOGON) BRACHYATHERUS, *Hochst.?*; *Steud. Syn. Gram.* 372.

*Hab.* Cameroons Mountains, alt. 8000 feet. (Fl. Dec.)

There are two forms thus marked from Abyssinia (Schimper): viz., No. 1635, a stout, broad-leaved form, tallying with the description of Steudel, of which I have very imperfect flowers; and another (Herb. Mus. Paris., Schimper, No. 95) with slender culms and very narrow, strict leaves. The Cameroons specimens accord best with the latter of these. The spikes are sometimes nearly 6 inches long. The second glume of the lower (sessile) spikelet is shortly awned both in Schimper's 95. and the Cameroons plants. The outer glume of the pedicelled spikelet is sometimes awned in the Cameroons specimens and sometimes muticous, but always awned in Schimper's 95. specimens.

28. ANDROPOGON (GYMNANDROPOGON) MANNII, *H.f.*, n. sp. Spithamæus ad pedalis, culmis cæspitosis simplicibus basi compressis foliosis apice sericeis, foliis distichis brevibus parce pilosis, vaginis latis compressis, lamina lineari acuta, spicis 2–5-pollicaribus rhachi ciliata, spiculis lanceolatis lævibus, inferioris basi barbatæ valvula exteriore acuminata subaristata, interiore aristata, arista glumam subæquante, superioris valvulis aristato-acuminatis.—*Ante*, vi. 23 (Gymnandropogon, sp?).

*Hab.* Fernando Po, alt. 8500–9000 feet. (Fl. Dec.–April.)

Glaberrima nisi pili sparsi in pagina superiore folii, apice culmi et rhachibus spicarum. *Vaginæ* 1 unc. longæ, $\frac{1}{8}$ unc. latæ, ligula brevissima sericea. *Folia* subcoriacea, stricta, 2 unc. longa, plana v. complicata, non convoluta. *Culmi* stricti, erecti, subrobusti. *Spicæ* purpurascentes. *Spiculæ* laxe imbricatæ, fere $\frac{1}{4}$ unc. longæ. *Flos* inferior *fœmineus,* superior *masculus.*

I cannot identify this with any described species, though it very closely resembles several Cape and African ones. Its short, stout, tufted habit, much compressed, glabrous, short sheaths, and short, stout, not convolute leaves distinguish it at once from the preceding.

29. ANDROPOGON (CYMBOPOGON) SMITHIANUS, *H.f.*, n. sp. Patentim pilosus v. glabratus, culmis 1–2-ped. foliosis apice ramosis, foliis elongatis superiorum vaginis inflatis, pedunculis longissime sericeis spathis inclusis, spicis 3–4 brevibus paucifloris densissime fulvo-villosis, spiculæ sessilis valvula exteriore truncata, interioris arista torta valvula duplo longiore.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec., Jan.)

*Gramen* pulcherrimum, erectum. *Vaginæ* longe pilosæ, ligulis breviusculis membranaceis. *Folia* 4–8 unc. longa, $\frac{1}{8}$–$\frac{1}{6}$ lata, scabrula. *Pedunculi* plurimi, graciles, 2–3 unc. longi, apices versus patentim longe pilosi. *Spicæ* pollicares et breviores, densissime sericeo-villosæ, pilis fulvo-brunneis.

A most beautiful species, at once distinguishable by the dark yellow-brown silky hairs of the spikes.

30. Andropogon (Cymbopogon) pusillus, *H. f.*, n. sp. Annuus, patentim pilosus, culmis gracilibus decumbentibus 2–5-pollicaribus foliosis, vaginis compressis, foliis linearibus acuminatis planis, pedunculis spathis inclusis, spicis binis brevibus paucifloris, spicularum valvulis exterioribus tenuiter aristatis dorso profunde bipertusis, floris hermaphroditi arista valida torta spicula pluries longiore.

*Hab.* Cameroons Mountains, alt. 7000 feet. (Fl. Dec.)

*Gramen* humile, debile, culmis e basi ramosis. *Vaginæ* ¼–½ unc. longæ, ligula brevi obtusa. *Folia* ½–1 unc. longa, stricta, ⅛ unc. lata, utrinque longe pilosa et basin versus longissime ciliata. *Spathæ* 1–1½-pollicares, glabræ, pedunculos filiformes glaberrimos distachyos velantes. *Spicæ* (aristis exclusis) ½ unc. longæ. *Spiculæ* 8–10; glumis glabris ⅙ unc. long., rhachi pedicellisque dense subdistiche sericeo-villosis. *Valvulæ* nitidæ, virides, exteriores apice bifidæ, inter dentes aristatæ, arista tenui valvulæ æquilonga, punctis intrusis magnis collateralibus. *Arista* flosculi hermaphroditi 1–1½ unc. longa, valida, torta, brunnea, scabrula.

A most distinct and very singular little grass, quite unlike any other known to me.

31. Arundinella elegantula, *H. f.*, n. sp. 3–4-pollicaris, annua, longe laxe pilosa, foliis ½-unc. lanceolatis acuminatis, panicula ovata ramis capillaribus flexuosis, glumis ovatis acuminatis longe pilosis, flosculi hermaphroditi palea inferiore bifida laciniis tenuiter aristatis dorso penicillis 2 pilorum aucta, inter lacinias aristata, arista valida torta spicula triplo longiore.

Cameroons Mountains, alt. 6000–7000 feet. (Fl. Dec.)

*Gramen* pusillum, debile, basi ramosum, longe laxe pilosum. *Culmi* basi decumbentes, tenues. *Folia* patentia, undulata v. recurva, ore longe ciliato. *Panicula* 1–1½-pollicaris, ramis plurimis flexuosis glaberrimis erecto-patentibus 2–3-floris ramulisque capillaribus. *Spiculæ* ⅛ unc. longæ. *Glumæ* longe laxe patentim subsetosæ, setulis basi tuberculatis, ovatæ, acuminatæ. *Palea* inferior fl. masculi glumis subsimilis sed longior, apice aristulata; fl. fertilis palea inferior brevis, basi et supra medium utrinque penicillis albis sericeis pilorum aucta, aristis lateralibus tenuissimis, intermedia valida, torta, geniculata, ⅓ unc. longa.

A very beautiful and distinct little grass, allied to the Abyssinian and Indian *A. Wallichii* (*A. pumila*, Steud.), but very different in its much smaller size, much larger, more hairy spikelets, and in the curious pencils of hairs on the lower fertile palea, which resemble those of the Australian *Danthonia semiannularis*. The

genus is South African, but not hitherto found in extratropical North Africa.

## CRYPTOGAMIA.

### 56. FILICES.

1. GLEICHENIA DICHOTOMA, *Willd.*
*Hab.* St. Thomas's Island, summit of the Peak.

2. CYATHEA, sp.
*Hab.* St. Thomas's Island, alt. 3000–7000 feet. Fernando Po and Cameroons Mountains.

3. ADIANTUM ÆTHIOPICUM, *L.*
*Hab.* Cameroons Mountains, alt. 7000 feet.

4. LONCHITIS GLABRA, Bory.
*Hab.* St. Thomas's Island, top of the Peak. Cameroons Mountains, alt. 7000 feet. Fernando Po.

A native of Natal and Bourbon.

5. HYPOLEPIS PTERIDIOIDES, *Hook.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 7000 feet.

6. CHEILANTHES FARINOSA, *Kaulf.*
*Hab.* Cameroons Mountains, in lava-fields, alt. 7000–10,000 feet.

7. PELLÆA HASTATA, *Link.*
*Hab.* Cameroons Mountains, alt. 7000 feet.

8. PTERIS 4-AURITA, *Retz.*
*Hab.* Cameroons Mountains, alt. 7000 feet.

9. PTERIS FLABELLATA, *Th.*
*Hab.* Fernando Po, alt. 7000 feet.

10. PTERIS AQUILINA, *Linn.*
*Hab.* Cameroons Mountains, alt. 7000 feet.

Also found at the level of the sea, on the Bagroo River and elsewhere in tropical Africa.

11. ASPLENIUM ANISOPHYLLUM, *Kze.*
*Hab.* Cameroons Mountains, alt. 3000–7000 feet.

12. ASPLENIUM ERECTUM, *Bory.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 3000–7000 feet.

A fern of ubiquitous tropical distribution.

13. ASPLENIUM MONANTHEMUM, *L.*
*Hab.* Fernando Po, alt. 8000 feet.

14. Asplenium protensum, *Schrad.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 7000 feet.

A native of Abyssinia, Mauritius, and South Africa.

15. Asplenium Serra, *Langsd.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 3000–7100 feet.

16. Asplenium furcatum, *Th.* Var. parvula, pinnis integris brevibus.
*Hab.* Cameroons Mountains, alt. 8000 feet.

The same state occurs in the Canary and Cape de Verd Islands.

17. Asplenium Adiantum-nigrum, *L.*
*Hab.* Cameroons Mountains, on lava-fields, alt. 10,000 feet.

Also found in Abyssinia, South Africa, and elsewhere on the tropical mountains of the Old and New World.

18. Asplenium Abyssinicum, *Fée.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 3000–7000 feet.

An Abyssinian fern.

19. Asplenium brachypteron, *Kze.*
*Hab.* Cameroons Mountains, alt. 3000–7000 feet.

20. Asplenium filix-fœmina, *L.*
*Hab.* Cameroons Mountains, alt. 7000 feet.

A small form of this very variable plant, of which other forms are found in Abyssinia, South Africa, &c.

21. Asplenium aspidioides, *Schl.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 5000–7000 feet.

A Madagascar fern.

22. Aspidium aculeatum, *L.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 7000–10,000 feet.

Also found in Abyssinia, South Africa, and elsewhere throughout the globe where the climate is sufficiently cool.

23. Nephrodium crinibulbon, *Hook.*
*Hab.* St. Thomas's Island, summit of the Peak. Cameroons Mountains, alt. 4000 feet.

24. Nephrodium filix-mas, *L.*
*Hab.* St. Thomas's Island, alt. 6000 feet.

A native of Abyssinia, Southern and Eastern Africa, and elsewhere throughout the world in cool moist climates.

25. NEPHRODIUM INÆQUALE, *Hook.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 7000–10,000 feet.

26. NEPHROLEPIS TUBEROSA, *Presl.*
*Hab.* St. Thomas's Island and Cameroons Mountains, alt. 4000–5000 feet.

27. POLYPODIUM VILLOSISSIMUM, *Hook.*
*Hab.* St. Thomas's Island, alt. 6000 feet.

Also found at Sierra Leone.

28. POLYPODIUM RUGULOSUM, *Lab.*
*Hab.* Fernando Po, alt. 7000 feet.

One of the most widely distributed of Ferns in the tropics and south temperate zone.

29. POLYPODIUM, n. sp.
*Hab.* Cameroons Mountains, alt. 7000 feet.

30. POLYPODIUM OPPOSITIFOLIUM, *Hook.*
*Hab.* Peak of St. Thomas's Island, alt. 5000 feet.

31. POLYPODIUM LORIFORME, *Wall.*
*Hab.* Peak of St. Thomas's Island, alt. 4000–5000 feet. Fernando Po, alt. 3000–5000 feet.

32. POLYPODIUM LEPIDOTUM, *Willd.*
*Hab.* Cameroons Mountains, alt. 9000 feet.

An American fern; also found in St. Helena.

33. GYMNOGRAMME JAVANICA, *Bl.*
*Hab.* St. Thomas's Island, alt. 4000–5000 feet. Fernando Po, alt. 10,000 feet. Cameroons Mountains, alt. 3000–7000 feet.

A widely distributed fern, extending through India to the Sandwich Islands.

34. GYMNOGRAMME TOTTA, *Schlecht.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 1000–7000 feet.

Found also in Madeira, throughout tropical Africa, and India.

35. GYMNOGRAMME LANCEOLATA, *Sw.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 3000–7000 feet.

A native of South Africa, India, and South America.

36. ACROSTICHUM HYBRIDUM, *Bory.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 4000–8000 feet.

A Bourbon and Tristan-d'Acunha fern.

37. Acrostichum Aubertii, *Desv.*
*Hab.* Fernando Po, alt. 7000 feet.

A Bourbon, East-African, and Venezuelan fern.

38. Acrostichum splendens, *Willd.*
*Hab.* Fernando Po and Cameroons Mountains, alt. 5000–6000 feet.

Found also in Sierra Leone, Madagascar, Bourbon, Ceylon, and the Sandwich Islands.

39. Acrostichum squamosum, *Sw.*
*Hab.* Cameroons Mountains, alt. 6000 feet. Tropical America, Indian and Pacific Islands, Madeira and Azores.

40. Acrostichum sorbifolium, *Linn.*
*Hab.* Fernando Po, from the sea to 5000 feet.

A very widely dispersed fern.

### 57. Ophioglosseæ.

1. Ophioglossum reticulatum, *Linn.*
*Hab.* Fernando Po, summit of the Peak.

A form of *O. vulgatum*, found in many warm countries.

### 58. Lycopodiaceæ.

1. Lycopodium crassum, *Hook.*
*Hab.* Cameroons Mountains, alt. 10,500 feet.

Also a native of Bourbon, Kerguelen's Land, and the Andes.

2. Selaginella, sp.
*Hab.* Fernando Po, alt. 8000 feet.

3. Selaginella, sp.
*Hab.* St. Thomas's Island, alt. 5000 feet.

### 59. Musci. (Described by Mr. Mitten, *ante*, p. 148.)

| | | feet. |
|---|---|---|
| Leptotrichum capillaceum, *Hedw.* | Cameroons Mountains | 7,000 |
| Dicranum obliquatum, *Mitt.*, n. sp. | Clarence Peak. | |
| —— stramineum, *Mitt.*, n. sp. | Cameroons Mountains | 9,000 |
| —— nivale, *Brid.* | „ | 9–10,000 |
| —— ericetorum, *Mitt.* | „ | 7–10,000 |
| Didymodon radicosus, *Mitt.*, n. sp. | „ | 8,000 |
| —— pungens, *Mitt.*, n. sp. | „ | 10,000 |
| Didymodon flexifolius, *Hook. & Tayl.* | „ <br> Clarence Peak, in the crater. | 8,000 |

| | | feet. |
|---|---|---|
| —— purpureus, *Hedw.* | Cameroons Mountains | 8,000 |
| —— cyathicarpus, *Mont.* | ,, | 8,000 |
| Anœctangium spathulatum, *Mitt.*, n. sp. | ,, | 8,000 |
| Tortula cylindrica (Weissia, *Bruch*) | ,, | 7,000. |
| Grimmia Abyssinica, *Br. & Sch.* | ,, | 12,000 |
| Zygodon semitortus, *Mitt.*, n. sp. | ,, | 8,000 |
| Macromitrium levatum, *Mitt.*, n. sp. | ,, | 8–10,000 |
| Entosthodon curvipes, *C. Muell.* | ,, | 7–8,000 |
| Funaria hygrometrica, *Dill.* | ,, | 7,000 |
| Bartramia stricta, *Brid.* | ,, | 7,000 |
| —— commutata, *Mitt.* | ,, | 12,000 |
| —— Halleriana, *Hedw.* | ,, | 9,000 |
| Philonotis Wilsoni, *Br. & Sch.* | Clarence Peak | 8,500 |
| Breutelia gnaphalea, *Mitt.* | Cameroons Mountains | 12,000 |
| —— diffracta, *Mitt.* | ,, | 5–9,000 |
| Mielichhoferia ovalis, *Mitt.*, n. sp. | ,, | 10,000 |
| —— basilaris, *Br. & Sch.* | ,, | 7–8,000 |
| Bryum julaceum, *Sm.* | ,, | 7,000 |
| —— argenteum, *L.* | ,, | 8,000 |
| —— alpinum, *L.* | ,, | 12,000 |
| —— pallescens, *Schw.* | ,, | 7–12,000 |
| —— flexifolium, *Br. & Sch.* | ,, | 8,000 |
| —— suberectum, *Mitt.*, n. sp. | Clarence Peak. | |
| —— subuliferum, *Mitt.*, n. sp. | Peak of St. Thomas's. | |
| Hypnum vellereum, *Mitt.*, n. sp. | Cameroons Mountains | 8,000 |
| —— spiculosum, *Mitt.*, n. sp. | ,, | (no elev.) |
| *Meteorium imbricatum, Beauv.* | ,, | 4–7,000 |
| | Clarence Peak | 8,000 |
| Trachyloma stipitatum, *Mitt.*, n. sp. | ,, | 7,500 |
| Stereodon Abyssinicus, *Br. & Sch.* | Cameroons Mountains | 7–8,000 |
| —— mollicellus, *Mitt.*, n. sp. | ,, | 4–5,000 |
| —— nitidifolius, *Mitt.*, n. sp. | Clarence Peak | 8,000 |
| —— fruticellus, *Mitt.*, n. sp. | ,, | 3–8,000 |
| —— frondosus, *Mitt.*, n. sp. | ,, | 3–8,000 |
| Lepidopilum deflexum, *Mitt.*, n. sp. | Cameroons Mountains | 4,000 |
| Neckera longirostris, *Hook.* | ,, | 7,000 |
| —— ramulosa, *Mitt.*, n. sp. | ,, | 4,000 |
| —— pennata, *Hedw.* | Clarence Peak | 6,000 |
| —— remota, *Br.* | Cameroons Mountains | 7,000 |
| Hedwigia imberbis, *Hook. & Tayl.* | ,, | 10–12,000 |
| —— rupestris, *Mitt.*, n. sp. | ,, | 10,000 |
| Leskea intricata, *Mitt.*, n. sp. | ,, | 7,000 |
| —— ramusculosa, *Mitt.*, n. sp. | Clarence Peak. | |
| Rhacopilum Africanum, *Mitt.*, n. sp. | Cameroons Mountains | 7,000 |
| Fissidens viridulus, *Schw.* | ,, | 7,000 |

| | | feet. |
|---|---|---|
| Mnium rostratum, *Schw.* | Clarence Peak. | |
| Daltonia patula, *Mitt.*, n. sp. | „ | 7,000 |
| —— longinervis, *Mitt.*, n. sp. | Cameroons Mountains | 4,000 |
| —— splachnoides, *Hook. & Tayl.* | „ | 8,000 |
| Cyclodictyon (Hookeria) lætevirens, *Hook. & Tayl.* | Clarence Peak | 8,000 |
| Hypopterygium laricinum, *Hook.* | „ | |
| Polytrichum Simense, *Br. & Sch.* | Cameroons Mountains | 8–10,000 |
| —— juniperinum, *Hedw.* | „ | 8–10,000 |
| —— commune, *Linn.* | Clarence Peak | 15,000 |

## 60. HEPATICÆ. (Described by Mr. Mitten, *ante*, p. 164.)

| | | |
|---|---|---|
| Jungermannia dentata, *Raddi* | Cameroons Mountains | 7,000 |
| —— hirtella, *Weber* | „ | 7,000 |
| —— Abyssinica, *Nees* | „ | 7,000 |
| —— geminifolia, *Mitt.*, n. sp. | Peak of St. Thomas's. | |
| Plagiochila squamulosa, *Mitt.*, n. sp. | Cameroons Mountains | 7–8,000 |
| —— dichotoma, *Nees* | „ | 4,000 |
| Leioscyphus repens, *Mitt.*, n. sp. | Clarence Peak | 8,000 |
| Lophocolea devexa, *Mitt.*, n. sp. | Peak of St. Thomas's. | |
| —— bidentata, *Nees* | Clarence Peak | 8,000 |
| —— muricata, *Nees* | „ | 8,000 |
| Gymnanthe decipiens, *Hook.* | „ | 8,000 |
| —— biloba, *Mitt.*, n. sp. | „ | 8,000 |
| Physiotium sphagnoides, *Hook.* | Peak of St. Thomas's. | |
| Sendtnera juniperina, *Sw.* | „ | |
| —— diclados, *Endl.* | Clarence Peak. | |
| Radula bipinnata, *Mitt.*, n. sp. | Cameroons Mountains | 4,000 |
| —— tamariscina, *Mitt.*, n. sp. | Peak of St. Thomas's. | |
| —— voluta, *Tayl.* | Cameroons Mountains | 8,000 |
| Madotheca subdentata, *Mitt.*, n. sp. | „ | 4,000 |
| Lejeunia acuta, *Mitt.*, n. sp. | Clarence Peak. | |
| —— Montagnei, *Gottsche* | Peak of St. Thomas's. | |
| Frullania emergens, *Mitt.*, n. sp. | Cameroons Mountains | 8,000 |
| —— depressa, *Mitt.*, n. sp. | „ | 8,000 |
| —— cordata, *Mitt.*, n. sp. | „ | 8,000 |
| —— angulata, *Mitt.*, n. sp. | „ | 8,000 |
| Plagiochasma Aitonia, *Lndb. & Nees* | „ | 7,000 |
| Dumortiera hirsuta, *Schw.* | „<br>Clarence Peak. | 4,000 |
| Targionia hypophylla, *Linn.* | Cameroons Mountains | 7,000 |
| Anthoceros dichotomus, *Raddi* | „ | 7,000 |
| Dendroceros crispatus, *Nees* | Peak of St. Thomas's. | |

### 61. LICHENES. (Named by Dr. Nylander.)

| | | feet. |
|---|---|---|
| Leptogium Burgessii, *Lightf.* | Cameroons Mountains | 7,000 |
| —— inflexum, *Nyl.* | " | |
| Stictina quercizans, *Mich.* | " | |
| —— fuliginosa, *Dicks.* | " | |
| Peltigera polydactyla, var. dolichorhiza, *Nyl.* | " | |
| —— rufescens, *Hoffm.* | " | |
| —— polydactyloides, *Nyl.* | " | |
| Usnea ceratina, *Ach.* | " | 8,000 |
| —— florida, *Ach.* | " | 8,000 |
| Stereocaulon turgescens, *Nyl.* | " | 7,000 |
| —— denudatum, *Fl.* | " | |
| Cladonia diplotypa, *Nyl.* | " | 6,000 |
| —— fimbriata, *Hoffm.* | " | |
| Ramalina scopulorun, *Ach.* | " | 8,000 |
| Physcia speciosa, var. dactylifera, *Nyl.* | " | 8,000 |
| —— ——, var. hypoleuca | " | 8,000 |
| —— dilatata, *Nyl.* | " | 8,000 |
| —— speciosa, *Wulf.* | " | 8,000 |
| Parmelia megaleia, *Nyl.* | " | 8,000 |
| —— revoluta, *Fl.* | " | |
| —— sp.? non typica | " | 8,000 |
| Urceolaria scruposa, *Ach.* | " | |
| Lecanora subfusca, var. allophora | " | |

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## On the Genus *Euptelea*, Sieb. & Zucc.

By DR. J. D. HOOKER and DR. T. THOMSON.

[Plate II.]

IN Siebold and Zuccarini's 'Flora of Japan' (a work which contains figures and descriptions of a great number of remarkable forms of plants, many of which extend to the eastern provinces of India) there is figured, at t. 72, a genus *Euptelea*, referred provisionally by the authors to Ulmaceæ, the absence of ripe fruit making it impossible to determine its affinities with certainty.

In preparing for distribution the monochlamydeous plants of the Griffithian Herbarium, we have been so fortunate as to meet with specimens in fruit of a plant evidently belonging to the same genus, perhaps even specifically identical with that figured and described by Siebold and Zuccarini. These specimens were collected by Griffith on the mountain Thumathaya, in the Mishmi country to the east of the valley of Assam, in an extremely humid district, the flora of which has very intimate relations to that of China and Japan. On the ticket attached to the specimens, Griffith refers them to Cupuliferæ; but he had, no doubt, examined them in the most cursory manner, as we can find no reference to the plant in any of his published works.

As the Mishmi specimens serve to complete the character of this very curious genus, and give better data for fixing its place in the system, we have thought it desirable to lay the accompanying drawing before the Society. Instead of describing Griffith's plant at length, it may be as well to give a brief abstract of the character of the flowering plant, and then to point out the additions which the new materials have enabled us to make.

In the Japan plant, according to Siebold and Zuccarini, the flowers are destitute of perianth, the sexual organs being seated on a shallow excavation at the end of the peduncle. They are polygamous, some consisting of carpels only, while others are hermaphrodite, or rather male with rudimentary female organs. The stamens and ovaries are numerous and indefinite, but equal in number. The anthers are adnate at the end of a short erect filament, 2-celled and laterally dehiscent, with a terminal apiculate connective. The ovaries are stalked, compressed, obovate, with no style, but a linear stigma lining the inner margin from the apex down to the point of insertion of the single pendulous ovule.

The Griffithian specimens have a very few old leaves only, in shape like those figured in the 'Flora Japonica,' and consist of slender twigs, with short lateral branchlets profusely covered with short pedicels, each supporting at its extremity a single flower, consisting of a fascicle of from 10 to 20 membranous samaræ. The apex of the pedicel is quite flat, and not excavated as in the flowering state of the Japan plant. The samaræ taper downwards into a stalk their own length, and are thin and membranous in texture, scarcely swelling out at the seeds, obovate in shape, with a deep notch about the middle on the ventral suture, marking the attachment of the seeds and the lower end of the narrow linear stigmatic surface, which extends upwards along the edge to the broad apex of the samara. The seeds are 2–4 in number, with a hard, black, brittle testa, granular but not oily albumen, and a small embryo not more than one-sixth the length of the albumen. They are quite anatropous, and are closely packed together, nearly filling the cavity of the samara, the greater part of which is a mere wing not separable into two laminæ.

The structure of this remarkable plant is so simple, and at the same time points in so many directions, that it is not easy to determine its nearest affinity. As we have said, Siebold and Zuccarini refer it to Ulmaceæ, remarking that its carpels, though indefinite, would, if united in the axis, form a fruit only differing from that of *Ulmus* in being polycarpellary. Though the structure of the fruit and seeds by no means confirms this conjecture, it is worthy of note that the Indian specimens had, in the rough sorting of Griffith's plants, found their way into Ulmaceæ, and therefore did not attract particular attention till that family was being arranged for distribution.

Technically, of course, from the entire absence of floral envelopes, our plant should be placed in the Incomplete division of Exogens; but when we try to find a place for it in any of the families of Monochlamyds, the result is anything but satisfactory. The families with an inferior ovary may, in the first place, be left out of the question; and from most of those with a superior ovary the absence of stipules and the minute embryo remove it to a distance. Indeed it is needless, we think, to compare it with any but the apocarpous Monochlamyds, Lauraceæ, Myristicaceæ, Monimiaceæ, Proteaceæ, Thymeleæ and Piperaceæ. With some of these *Euptelea* agrees in the minute embryo, but in all other respects it is too different to make it possible to associate it with any of them in the same family. The minute embryo is no doubt a character of great importance, though not necessarily a mark of affinity, and existing in too many families to be available for the determination of affinity.

The stamens and carpels of *Euptelea* are so evidently seated on the torus, that we need not compare it with any calycifloral families. There is no doubt something in the habit which suggests a relationship to certain Saxifrageæ and to Hamamelideæ, but there is nothing in the essential characters to support this resemblance.

It is therefore among apocarpous Thalamifloræ, as a reduced and anomalous type, that *Euptelea* must find a place, unless indeed it be thought preferable to constitute of it a distinct family, in which case it would of course go to Incompletæ. This we think would be an unsatisfactory step; for although there is no family of apocarpous Thalamifloræ to which it can be referred without hesitation, it approaches several of them so very closely that its natural place seems to be in close proximity to them. The numerous samaroid carpels resemble a good deal those of *Thalictrum*; but the characters of the seed, and especially of the albumen, do not confirm this resemblance, while the habit is too different from that of Ranunculaceæ to make it desirable to place it there. The hard testa of the seed, the granular albumen, and the minute embryo agree with Magnoliaceæ; but the serrate leaves, with a sheathing base without stipules, are nowhere found in that order. In this character of the leaves—and further, in their close straight venation—we have an approach to Dilleniaceæ, from which the samaroid carpels and the want of an aril are sufficient distinctions. Anonaceæ and the other apocarpous families are too different to afford grounds of comparison.

The nearest affinities of *Euptelea* appear to us to be with Ranunculaceæ and Magnoliaceæ; and though, in the absence of floral envelopes, there is no very marked line of demarcation between these two families, yet the woody habit and the structure of the seed incline the scale in favour of Magnoliaceæ, in the first section of which, Wintereæ, which is characterized by the want of stipules and by the carpels forming a single verticil, we propose for the present to leave this very anomalous plant.

Were it not that Siebold and Zuccarini described their plant as one-ovuled, we should consider the Indian species identical with that of Japan. As this is a point on which a mistake is not probable, we propose to call the Mishmi plant *E. pleiosperma*, resting the diagnosis on the presence of 2–4 seeds in the ripe samara*.

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## A New Genus of *Hepaticæ*. By W. MITTEN, A.L.S.

[Read December 17, 1863.]

### ADELANTHUS.

*Perianthium* in ramulo brevi ventrali ad basin ramorum celatum, tubulosum, subtrigonum, ore connivente dentato. Involucri folia trifaria. *Flores* masculi in spicis parvis ventralibus. *Caulis* inferus procumbens, intricatus; stoloniferus aphyllus, ramis simplicibus erectis curvatis. *Folia* disticha, fere verticalia, margine dorsali decurrente.

A. FALCATUS. Jungermannia falcata, *Hook. Musci Exot.* t. 89. Plagiochila falcata, *Synops. Hepat.* 649. Alicularia occlusa, *Hook. f. et Tayl. Crypt. Antarct.* t. 62. f. 8.

*Hab.* New Zealand, *Menzies and Colenso*; Tasmania, *Gunn and Oldfield.* Lord Auckland's Islands and Campbell's Island, *Dr. J. D. Hooker.*

This species, so well figured in the 'Musci Exotici,' has been long misunderstood from Dr. Taylor's mistake in considering the perianths to belong to some *Aneura* accidentally intermixed with the original specimens; but so great is the resemblance of the habit and foliage to some well-known species of *Plagiochila*, as *P. opposita*, Nees, and *P. conjugata* (*Jungermannia*, Hook. Musci Exot. t. 91), that it was hardly to be expected that the fructification could be so different; add to this the fragility of the perianth itself, which seems partially decayed by the time the capsule has arrived at maturity, and it is easy to account for the error.

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* Within the last few days we have had an opportunity, through the kindness of Professor Miquel, of examining the carpels of *E. polyandra*, which are one-ovuled, as figured by Siebold and Zuccarini.

A. MAGELLANICUS. Perianthio elliptico-oblongo, apice dentato; involucri foliis parvis, dentatis.—*Plagiochila Magellanica*, Lindenberg, Sp. Hepat. 164; Synops. Hepat. 53. *P. sphalera* et *P. unciformis*, Hook. fil. et Tayl. Crypt. Antarct. t. 156. f. 5 et 8.

*Hab.* Magellan, *Montagne in Hb. Hook.* Hermite Island, Cape Horn, *Dr. J. D. Hooker*. Staten Land, *Menzies*. Cordillera de Raneo, Chili, *Lechler*, No. 2943. Chimborazo, *Jameson*. Falkland Islands, *Lechler*, No. 104. Tasmania, *Gunn*, *Hb. Hooker*.

Very variable in size, from half an inch to three inches in height, and the outline and denticulation of the inferior leaves is also variable; in the Tasmanian specimens all the leaves are entire, but there appears to be no other difference.

A. LINDENBERGIANUS. Plagiochila Lindenbergiana, *Lehm. in Linnæa*, iv. p. 367; *Pugill.* pl. iii. p. 53; *Syn. Hepat.* 59.

*Hab.* Cape of Good Hope, *Ecklon and Milne*.

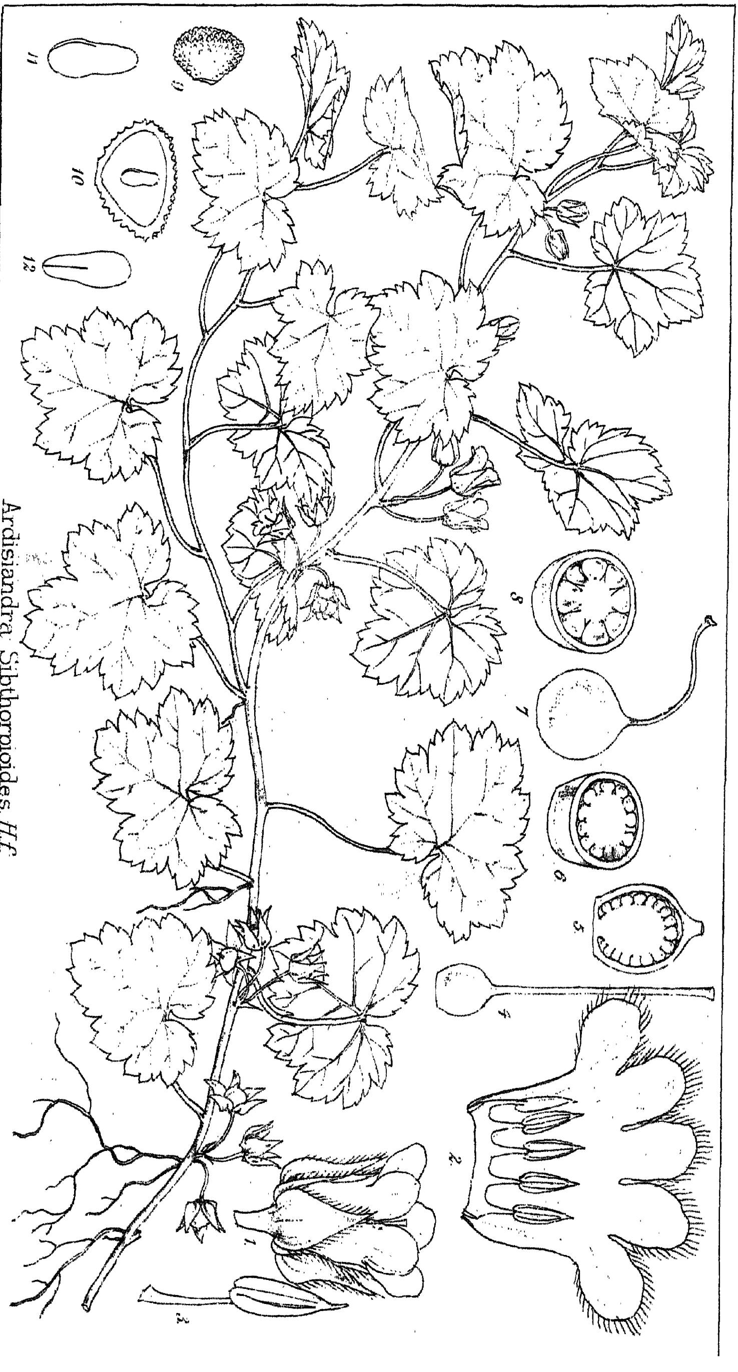
Leaves rather more acute than is usual in the preceding species, but presenting no other difference; and unless some character is afforded by the perianth, as yet unknown, it can scarcely be distinguished.

A. DICIPIENS. Foliis involucralibus rotundatis, concavis, brevidentatis; perianthio ovato, ore parvo dentato.—*Jungermannia decipiens*, Hook. Brit. Jung. t. 50. *Plagiochila decipiens*, Nees et Mont.; Lindenberg, Species Hepat. t. 12; Gottsche, Lindenberg et Nees, Synops. Hepat. p. 24. *Plagiochila campylodonta*, Hook. fil. et Taylor in Lond. Journ. Bot. 1845, p. 80; Synops. Hepat. p. 639. *Gymnanthe decipiens*, Mitten in Journ. of the Proc. Linn. Soc. vol. vii.

*Hab.* Ireland, first gathered by *Miss Hutchins*. St. Helena, *Dr. Hooker*. Fernando Po, *Mr. G. Mann*. Quito, *Prof. Jameson*. Peru in Monte Tunguragua, *Mr. Spruce*.

The discovery of the perianths on Mr. Spruce's specimens has at length set at rest the hitherto doubtful place of this species, which has considerable resemblance to some species of *Plagiochila* and *Gymnanthe*.

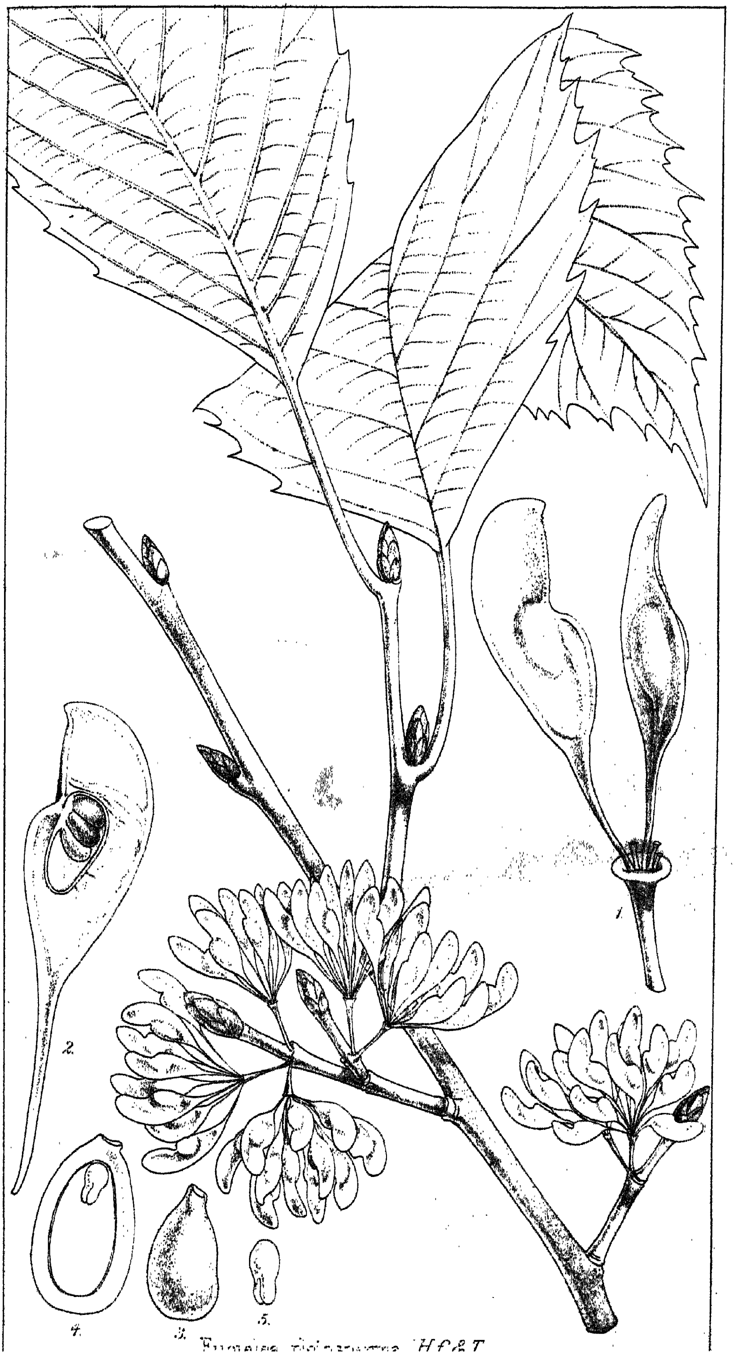
The position of this genus appears to be near to *Sphagnœcetis*, Nees; and in the substance of its leaves, male inflorescence, and form of the perianth it entirely agrees; but differs in the erect branches, absence of stipules, and in the insertion of its appressed secund leaves.



Ardisiandra Sibthorpioides, *H.f.*

W. Fitch, del. et lith.

Vincent Brooks Imp.



Euptelea pleiosperma H.f. & T.

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THE END.

Printed by TAYLOR and FRANCIS, Red Lion Court, Fleet Street.

# JOURNAL OF THE PROCEEDINGS

OF THE

# LINNEAN SOCIETY OF LONDON.

## Contributions to the Cryptogamic Flora of the Atlantic Islands.

By WILLIAM MITTEN, A.L.S.

[Read Nov. 5, 1863.]

[PLATES I. & II.]

THE Moss-Flora of the Azores, the Canaries, and Madeira, so far as it is possible to judge from the small collection from the Azores given by Mr. H. C. Watson, the enumeration of those from the Canaries by Dr. Montagne in Webb and Berthelot's 'Hist. des Iles Canaries,' and the collections brought home year by year by Mr. J. Y. Johnson on his return from his winter residence in Madeira, would appear to be very nearly identical. Nearly all the species enumerated from the Canaries have already been detected in Madeira; but, even when allowance is made for the position of the Flora as belonging to the Mediterranean region, there still remain a number of species attributed to that Flora which ought to occur in Madeira. Besides the presence of a few species so far as yet known peculiar to the Atlantic Islands, as *Astrodontium Canariense* and *Neckera intermedia*, Brid., their Flora contains some other species which, although hitherto known to occur in very few places in Europe, may be expected to be found on the south or western coasts of the British Islands. That this supposition is not unreasonable is proved by the finding of *Myurium Hebridarum*, Schimp., a moss common to the Azores and Madeira, in the Hebrides. Amongst the specimens obtained by Mr. Johnson in Madeira are three remarkable species, supposed, in the accompanying descriptions, to belong to the Leskeoid mosses; of these only one has as yet been met with in fruit; but the presence of these three closely allied species in such a circumscribed area is interesting, for it is only in Australia, Tasmania, and New Zealand that two certainly congeneric species are known to exist. To these are added descriptions of a few other curious species, chiefly from Madeira.

## MUSCI.

### ANŒCTANGIUM, *Schw.*

A. ANGUSTIFOLIUM, sp. nov. Caule brevi gracili, foliis patentibus linearibus basi paululo angustioribus concavis apice acutis nervo percurrente, cellulis basi paucis quadratis pellucidis sensim in minutas rotundatas subleves transeuntibus, perichætialibus ovato-lanceolatis, theca in pedunculo gracili obovata.

*Hab.* Teneriffe, "ad rupes sylvarum," *Schmidt in Herb. Hooker.* no. 46.

Less than *A. compactum*, Schl., and softer. The leaves are about ten times as long as broad, pale green, subcrispate when dry; the cells very minute, but distinct.

*A. compactum* occurs in Teneriffe and Madeira, and grows associated with *Zygodon curvipes*, C. Müller, a moss which is found also on the mountains of Abyssinia and does not appear to differ from *Z. cyathicarpus*, Mont., so widely distributed in the southern hemisphere.

### GLYPHOMITRIUM, *Brid.*

(*Ptychomitrium*, Schimp.)

G. PULVINARE, sp. nov. Monoicum, pulvinatum, foliis patentibus incurvis e basi subovata lanceolatis acutis nervo excurrente marginibus integerrimis, cellulis basi paucis quadratis rectangulatis cito in parvas rotundatas approximatas transeuntibus diametro circiter $\frac{1}{2000}$ unciæ metientibus, perichætialibus conformibus, theca in pedunculo trilineari obovata, operculo rostro theca dimidio breviore, peristomio dentibus brevibus solidis.

*Hab.* Madeira, on rocks, *Johnson.*

Growing in small hemispherical tufts of a dull dark green colour, much resembling *G. crispatum*, Bridel = *Grimmia crispata*, Hook., but with leaves having the cells of the upper portion much larger and those of the base not elongated. *G. polyphyllum*, Dicks., is abundant and very fine in Madeira.

According to M. Schimper, *Ptychomitrium*, to which he refers *G. polyphyllum* and some other species, differs from *Glyphomitrium* in having the teeth of its peristome not approximated in pairs and not hygroscopic; and *Brachysteleum* of Hornschuch (an older name applied to the same species) he is willing to retain for the reception of such species as have a short seta; but these are al the distinctions upon the strength of which they are to be considered coequal genera with *Glyphomitrium.*

*Brachyodus,* Nees et Hornschuch, and *Campylosteleum,* Bruch et Schimper, owe their distinction from *Glyphomitrium* chiefly to their diminutive size; besides which, the only characters in *Brachyodus* are the short peristome and the plication of the empty capsule, and in *Campylosteleum* the curved fruitstalk; for in the latter the peristome is similar to that of *Ptychomitrium.* All the species of these supposed genera agree in the areolation of their leaves, the mitriform calyptra, and in having a peristome which among them passes through similar forms to those observable in *Grimmia,* to which they appear to form an allied and closely related genus—differing in habit and areolation, but agreeing in the structure of the peristome, the highest development of which appears in *Glyphomitrium polyphyllum* and *Grimmia* (*Rhacomitrium*) *canescens,* Dill.

### ULOTA, *Brid.*

**U. VITTATA,** sp. nov. Habitu staturaque *U. Bruchii,* foliis patentibus siccitate crispatis e basi latiore subovata sensim lineari-lanceolatis apice obtusiusculis nervo carinatis integerrimis, cellulis basi ad latera seriebus singulis hyalinis quadratis interioribus ad nervum elongatis angustis, ad margines usque ad folii medium seriebus circiter sex cellularum elongatarum angustarum vittam plus minus distinctam formantibus, theca ovali sensim in pedunculum attenuata siccitate plicata rubrofusca, peristomio *U. Bruchii,* calyptra ramentis paucis brevibus appressis.

*Hab.* Madeira, on trees on the mountains, *Johnson.*

Different from *U. crispa,* Hedw., and *U. Bruchii,* Hsch., in its calyptra and in the presence of the bands of elongated cells, which are not truly marginal, for a single row of rounded cells forms the margin; this vittation is not uniformly evident in every leaf, but is generally so. The rounded cells of the upper part of the leaf are about half the size of those of *U. crispa.*

### BRYUM, *Dill.*

**B. NOTARISII,** sp. nov. Dioicum, dense cæspitosum, nitidum, foliis confertis patentibus ovato-lanceolatis apice latiusculo apiculo parvo sensim acuminatisve nervo crassiusculo in mucronem excurrente, margine superne parce denticulato medio recurvo, cellulis basi quadratis oblongis deinde longioribus prosenchymaticis, perichætialibus basi latioribus, theca in pedunculo gracili rubro horizontali pendulave clavata rubra, operculo conico, peristomio dentibus angustis elongatis pallidis, interno carente.—*B. alpinum*, var. *Mediterraneum*, De Notaris, Syll. p. 129. *B. princeps* et *nuperius*, *B. gemmiparum*, ejusd. MS. *B. semicompletum*, Mitten in lit.

*Hab.* Madeira, on the earth in moist places, *Johnson*. In insulis freti Bonifacii maris Mediterranei, *De Notaris*.

Intermediate in size between *B. alpinum*, Linn., and *B. Sauteri*, B. et S., but most nearly allied to the former, from which it is distinguished by its smaller size, short densely tufted stems, and the form and substance of the leaves. In all the specimens yet examined there has been no trace of internal peristome.

B. OBOVATUM, sp. nov. Dioicum, foliis patentibus obovatis rigidis nervo crasso breviter excurrente mucronatis, margine crasso tereti superne parce indistincte denticulato, cellulis fere omnibus conformibus utriculo repletis basi nec oblongis nec rectangularibus, theca in pedunculo elongato clavato-cylindracea pendula, operculo conico, peristomio normali.

*Hab.* Madeira, near Funchal, on the earth, 1858, *Johnson*.

Like *B. Donianum*, Grev., in size and habit, but with leaves twice as wide, having a firm terete margin, and cells much smaller; in the same particulars it differs from *B. capillare*, Hedw., which is also found in Madeira.

## LEPIDOPILUM, *Brid.*

### (*Tetrastichium.*)

L. FONTANUM, sp. nov. Caule prostrato viridi vage ramoso simplicive, foliis quadrifariis compressis planis, seriebus dorsalibus divergentibus majoribus elongato-oblongis apice acuminatis basi asymmetricis margine apice serrulatis inferne integerrimis enerviis, seriebus ventralibus patenti-divergentibus angustioribus ovali-lanceolatis subintegerrimis, cellulis laxissimis prosenchymaticis pellucidis.

*Hab.* Madeira, Joaõ Gomez Ravine, about springs, *Johnson*.

The specimens of this fine moss are too fragmentary to give a good idea of its habit; it appears to be prostrate, but not rooting. Some of the specimens are more than 2 inches long, and produce irregular branches resembling the main stem; others have numerous short branches with uniform small oval obtuse leaves, still retaining, however, the quadrifarious arrangement; but in both cases the branches are confined to one side of the stem. The leaves are pale glaucous green, and so inserted as to leave the stem continuously visible along the dorsal side; the arrangement in four series is similar to that of *L. Patrisiæ*, Hampe, but the relative size of the series is reversed.

*Hookeria Splitgerberi*, Mont., is, from the description, evidently another member of this small group, which differs from *Lepidopilum* in wanting the dorsal, medial, and ventral series of leaves.

*Hookeria læte-virens*, Hook. et Tayl., is found in Madeira, and in its pale appearance and size has some resemblance to *L. fontanum*, but the areolation of its leaves, as well as their insertion, is different.

### SEMATOPHYLLUM, gen. nov.

Pleurocarpicum. Habitus, fructus peristomiumque *Hypni*. *Folia* cellulis alaribus utplurimum utrinque tribus distinctis signata.

(*Rhaphidorrhynchum*, Schimp.)

S. AURICOMUM, sp. nov. Monoicum, caule prostrato fusco ramis brevibus pinnato, foliis patentibus anguste ellipticis longe subulato-attenuatis concavis enerviis integerrimis, cellulis elongatis angustis, alaribus utrinque tribus fuscis, perichætialibus patentibus e basi subovata sensim angustatis integerrimis breviter nervatis, theca in pedunculo gracili rubro elongato apice cygni colli flexo ovali-cylindracea subinæquali ætate curvata, peristomio dentibus crassis intus valde trabeculatis, processibus carinatis solidis, ciliis binis subæquilongis lævibus.

*Hab.* Madeira, on decayed wood, *Johnson.*

A small species, closely investing the wood, of a yellow and rather glossy appearance, related to *S.* (*Hypnum*) *leptocarpum*, Schw., but much less; allied also to *S. demissum*, Wils.; not, however, very nearly resembling it or any other European moss.

The numerous tropical species belonging to this group are readily distinguished from the *Hypna* and *Stereodontes* by the presence of the enlarged alar cells, which are distinct in form and colour from the rest of the substance of the leaf. Their affinity is remote from *Rhynchostegium*, Schimp., of which his *Rhaphidostegium* was made a section, to include *Hypnum demissum*, Wils.

### STEREODON, *Brid.*

S. CANARIENSIS, sp. nov. Dioicus, cæspitosus, caule procumbente pinnatim ramoso, foliis falcatis secundis compressis ovato-lanceolatis ovali-lanceolatisque sensim acutis, marginibus superne argute serrulatis, nervis binis brevibus, cellulis elongatis longitudine circiter $\frac{1}{7000}$–$\frac{1}{8000}$, latitudine $\frac{1}{5000}$ unciæ metientibus, ad angulos paucis obscurioribus, perichætialibus erectis elliptico-lanceolatis apicibus serrulatis, theca in pedunculo elongato gracili brevi ovali inæquali horizontali, ore magno, operculo conico acuminato, peristomio interno processibus solidis ciliis binis æquilongis in membrana fere ad dentium medium exserta.

*Hab.* Canaries, *ex Herb. Webb.*; Teneriffe, *Bourgeau, in Herb. Hook.*; Madeira, *Johnson*; Ireland, on Turk Mountain, 1829, *Wilson.*

Nearly resembling *S. cupressiformis*, Brid., in the state called "*mammillatus*," but differing from all states of that variable moss in the sharp serrulation of its leaves and in the size of the cells —about half as long and nearly twice as wide. In some specimens the capsule is very short—not longer than wide.

### HYPNUM, *Dill.*

### (*Rhynchostegium*, Schimp.)

H. SURRECTUM, sp. nov. Monoicum, caule repente radicante ramis pluribus brevibus pinnatim ramoso, foliis patentibus sursum curvatis surrectis nitidis e basi ovata longe subulato-lanceolatis, nervo medio evanido, marginibus integerrimis in ramulorum apicibus serrulatis, cellulis basi paucis majoribus latioribus superioribus elongatis angustis, perichætialibus subsecundis ovatis subulato-acuminatis subserrulatis nervo brevi, theca in pedunculo brevi lævi ovali horizontali, operculo subulato longirostrato, peristomio interno processibus perforatis, ciliis duobus dimidio brevioribus, in membrana fere ad dentium medium exserta.

*Hab.* Madeira, on stones, *Johnson.*

A shining green moss, in size resembling *H. confertum*, Dicks., and in the form of its leaves intermediate between it and *H. tenellum*, Dicks. It is remarkable for having all its leaves curved upwards in the same way as those of *H. resupinatum*, Wils.

### (*Amblystegium*, Schimp.)

H. MADERENSE, sp. nov. Monoicum, caule repente latissime cæspitoso pinnatim ramoso, foliis patenti-divergentibus e basi subovata sensim subulato-lanceolatis, nervo percurrente, marginibus integerrimis subserrulatisve cellulis oblongo-ellipticis, perichætialibus erectis convolutis ovato-lanceolatis obtusatis nervo excurrente mucronatis plicatis, theca in pedunculo gracili rubro longissimo arcuata cylindracea, operculo convexo apiculato, peristomio interno processibus latis solidis, ciliis binis æquilongis interpositis, in membrana fere ad dentium medium exserta.

*Hab.* Madeira, on rocks and the earth, *Johnson*, and *Milne in Herb. Hook.*; Canaries, *Montagne.*

This fine species has the habit and appearance of *H. serpens*, Linn., but is in all its parts far larger and more rigid. It grows in extensive patches of a fresh green or, sometimes, brownish colour; the fruitstalks are about 2 inches long. In the areolation of its leaves it is intermediate between *H. serpens* and *H. varium*, Beauv.

### NECKERA, *Hedw.*

### (*Homalia*, Brid.)

N. SUBRECTA, sp. nov. Habitu *N. trichomanoidis* simillima, foliis patentibus obovatis basi angustatis apice rotundatis crenulatis apiculo brevi, nervo distincto ad $\frac{3}{4}$ evanido, cellulis minoribus, perichætialibus ovatis acuminatis apicibus denticulatis, theca in pedunculo elongato brevi ovali inclinata, operculo conico-acuminato, peristomio interno processibus perforatis ciliis brevibus rudimentariis interpositis in membrana fere ad dentium medium exserta.

*Hab.* Madeira, Santa Luzia Levada, about the roots of *Thamnium alopecurum*, *Johnson.*

Very closely resembling *N. trichomanoides*; but its leaves are scarcely at all curved, the nerve stouter and longer, and the lower portions of the leaves narrowed, so that their figure is uniformly obovate.

### LESKEA, *Hedw.*

### (*Sciaromium.*)

*Caulis* primarius repens, radicans; rami erecti, inferne simplices, superne pinnati pendulive prolixique, ramosi. *Folia* rigida, opaca, sublævia, uninervia. *Cellulæ* parvæ, rotundatæ. *Phyllidia* nulla. *Peristomium* normale.

L. SPINOSA, sp. nov. Caule primario repente radicante, ramis erectis rigidis superne ramosis frondem stipitatem formantibus, foliis obscure viridibus rigidis patentibus e basi ovata sensim longe subulatis, nervo crasso concolore in apice evanido, marginibus apice parce remote dentatis alibi integerrimis, cellulis minutis rotundatis longitudine $\frac{1}{2000}$, latitudine $\frac{1}{3000}$ unciæ circiter metientibus lævibus.

*Hab.* Madeira, *Johnson and Mason*; Azores, *Hunt*, from *Watson.*

In all respects very similar to *Hypnum hispidum*, Hook. f. et Wils. Crypt. Antarct. t. 61, but more robust, and with leaves having the nerve when closely examined not excurrent but vanishing in the upper portion of the points, which too are dentate. The cells are also rather smaller.

Judging from the specimens, it would appear that well-developed stems would be from 4 to 6 inches high, and less curved than is usual in *H. hispidum.*

L. PROLIXA, sp. nov. Habitu *L. spinosæ* sed graciliore mollioreque, foliis patenti-erectis ovatis acuminatis leniter biplicatis, nervo lato crasso sub apice evanido, marginibus superne indistincte serrulatis, cellulis parvis ovalibus inter se remotiusculis lævibus, perichætialibus elongatis erectis late lanceolatis acuminatis superne serrulatis, nervo in apice evanido, theca in pedunculo gracili subunciali rubro apice curvato breviter ovali æquali, collo nullo, operculo conico acuminato, peristomio dentibus luteis subulatis, processibus subæquilongis carinatis perforatis, ciliis tribus appendiculatis interpositis in membrana ad $\frac{1}{3}$ dentium longitudinis exserta.

*Hab.* Madeira, near Funchal, 1857, *Johnson.*

Habit similar to the preceding, but not so rigid nor of so dull a green colour. Ramification less stiff; and some branches are produced as if they had grown in a subpendulous manner. The leaves are not subulate; the nerve wider, and vanishing considerably below the apex.

L. SETIGERA, sp. nov. Habitu *L. spinosæ*, foliis patenti-secundis ovatis concavis, marginibus minute crenulatis, nervo crasso compresso viridi excurrente folii longitudinem triplo superante lævi, cellulis parvis ovoideis basi paucis longioribus.

*Hab.* Madeira, 1862, *Johnson.*

In aspect entirely similar to *L. spinosa*, but in the few stems yet seen less distinctly pinnate, although forming the same tree-like branches. The great length of the firm and stout green nerve is remarkable.

The species composing this group, and including the *Hypnum hispidum*, Hook. f. et Wils., are here placed as a section of *Leskea*, that being the oldest name under which certain species having the structure and habit of *L. polycarpa*, Ehrh., were distinguished from *Hypnum*, and, like most of the earlier genera, established upon peristomial characters only. But with an extensive series of species it becomes evident that the most perfect form known amongst the mosses having the same areolation and mode of growth is found in *L. tamariscina* (*Thuidium*, Schimper), notwithstanding the apparently different habit and ramification; for in this species the peristome has the same development as in the most complete forms of *Hypnum* and *Bryum*; and diverse as *L. polycarpa* looks in imperfect specimens, when examined in favourable situations it is found to produce occasionally free stems which in ramification and appearance closely resemble *L. abietina* (*Thuidium*, Schimp.); and from this last species the transition into the more branched forms is so easy when even the allied European species are compared, that M. Schimper has not ventured to separate it from his *Thuidium*. And as to the peristome of *Leskea*, taking for example again *L. polycarpa*, it will be observed that it does not differ in structure from that of *L. tamariscina*, but only in the non-development of those parts of the internal peristome which are present in that species, and that the group of *Leskeæ* with erect capsules and imperfect peristomes is precisely analogous to *Pylaiesia* and *Homalothecium*, Schimp.,—*Pylaiesia* having just the same position with regard to *Stereodon cupressiformis*, Brid., and *Homalothecium* to *Hypnum rutabulum*, Dill. In *Hypnum hispidum* and in *L. prolixa* the peristome is fully developed, and the habit approaches to that of *Thuidium*; but the stems and branches are destitute of the phyllidia so general amongst Leskeoid mosses, and the cells of the leaves are but very slightly papillose. M. C. Müller places *Hypnum hispidum* by the side of *H. fluviatile*, Sw.; but the habit and capsule are different, and the substance of the leaves more rigid. Besides the *H. hispidum*, there is in New Zealand another species belonging to the same group, *Leskea umbrosa*, M.; but little can be said of its habit, for small specimens only have yet been seen. *Hypnum nervosum*, Hooker, and *H. crispulum*, Dzy. et Molk., appear to be possessed of the same habit, but are much less. In time other species may be discovered, which will either confirm the position of the group in *Leskea*, or perhaps show them to be some modification of *Hypnum* with a dense areolation.

## HEPATICÆ.

### LEJEUNIA, *Dumort.*

L. JOHNSONIANA, sp. nov. Caule repente vage ramoso, foliis divergentibus orbiculari-ovatis angulo parvo acutis, basi lobulo subsaccato inflexo oblongo apice bidentulo, amphigastriis orbiculari-obovatis integerrimis, perianthio compresso obovato obtuso, ore parvo apiculato, utrinque ala dentata marginata, foliis involucralibus elliptico-oblongis apice paucidentatis, amphigastrio majore obtuso.

*Hab.* Madeira, creeping on *Madotheca Canariensis*, Nees, *Johnson*, 1859.

Whole plant brown, about the size of *L. serpyllifolia*, Lib., but agreeing in the form of its perianth with *L.* (*Phragmicoma*) *Mackaii*, and thus removed from the vicinity of the species which are allied to *L. subfusca*, Nees, with which it agrees in the form and substance of its leaves as well as in size and colour.

## EXPLANATION OF THE PLATES.

### PLATE I.

*Leskea spinosa.* Plant, natural size; leaf, magnified.

*Leskea prolixa.* *a*, Plants, natural size. *b*, Leaf; *c*, perichætial leaf; *d*, capsule; *e*, portion of peristome: all magnified.

*Leskea setigera.* Plant, natural size; leaf, magnified.

PLATE II.

*Sematophyllum auricomum.* *a*, Plant, natural size. *b*, Leaf; *c*, perichætium and male flower; *d*, capsule; *e*, portion of peristome: all magnified.

*Hypnum surrectum.* *a*, Plant, natural size. *b*, Leaves; *c*, perichætium and male flower; *d*, capsule; *e*, portion of peristome: all magnified.

*Lejeunia Johnsoniana.* *a*, Plant, natural size. *b*, Portion of stem with leaves and stipules; *c*, involucral leaf detached; *d*, perianth, with involucral leaves and stipule; *e*, transverse section of perianth.

## A New Genus of *Asclepiadeæ*. By N. A. DALZELL, Esq., Superintendent of the Botanical Gardens, Bombay. Communicated by Dr. THOMSON, F.L.S.

[Read March 3, 1864.]

[PLATE III.]

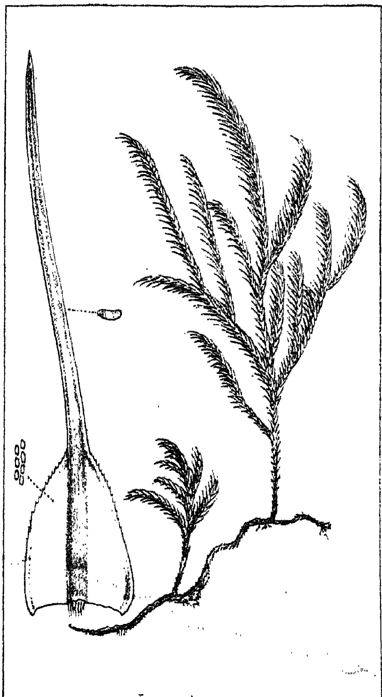
### FRERRA.

*Calyx* 5-partitus. *Corolla* glabra, rotata, 5-lobata, lobis late triangularibus, margine pilis raris aplanatis fimbriatis, sinu parvo acuto inter lobos. *Corona staminea* gamophylla simplici serie 10-lobata, nempe lobis 5 laciniis corollinis oppositis, latis brevissimis, sinuato-truncatis, 5 iis alternis ligulatis, antheris incumbentibus, apice truncatis. *Antheræ* apice simplices; massæ pollinis erectæ, supra basin affixæ, margine interiore linea aurea pellucida instructæ. *Stigma* muticum. *Folliculi*?—*Herba* Indica perennis humilis cæspitosa ramosa saxicola, caulibus teretibus albidis lævibus, foliis breviter petiolatis oblongis carnosis, floribus extra-axillaribus solitariis, brevissime pedunculatis.

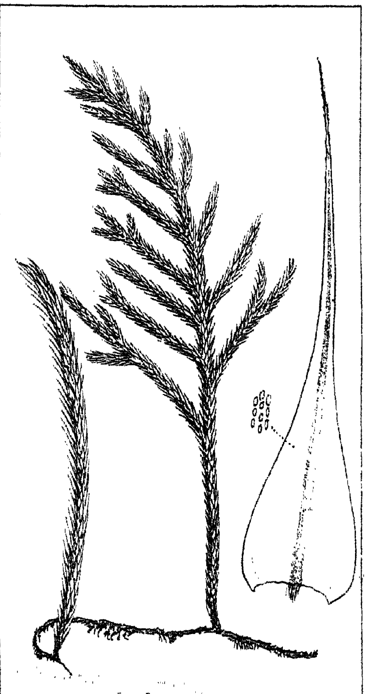
1. F. INDICA, *Dalzell.*

*Hab.* Concan, alt. 3000 ped.

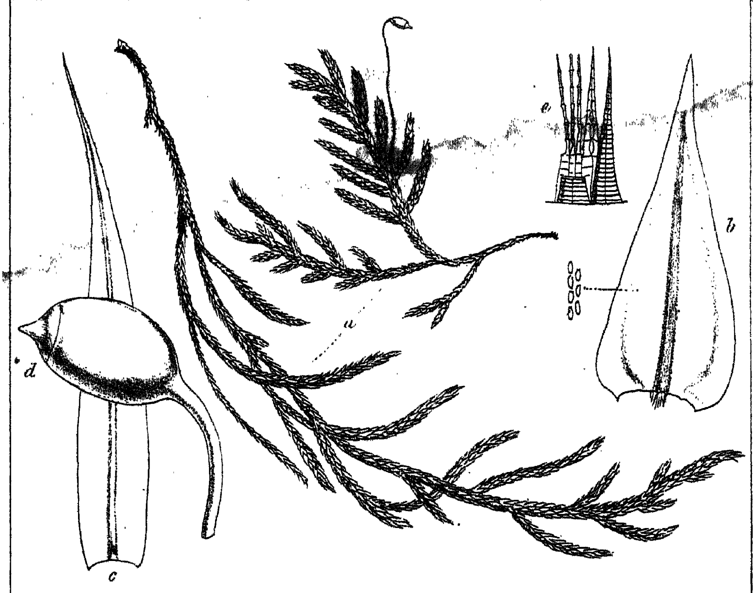
I met with this plant while botanizing a few days ago on a hill-fort in this neighbourhood, 3000 feet high. It was growing in large flattish patches on the bare rock on the western face of the hill. The flowers were pretty numerous; they are of a purplish-red colour, with an irregular small pale-yellow spot in the middle of each lobe; the staminal crown is dark purple, five of its segments resting on the edge of the stigma, which is of a pearly lustre. Between these five segments lie the anthers, which are quite exposed, of a fine red colour, their bases diverging, and having a line of a transparent golden or amber colour along their inner margin,



L. setigera.

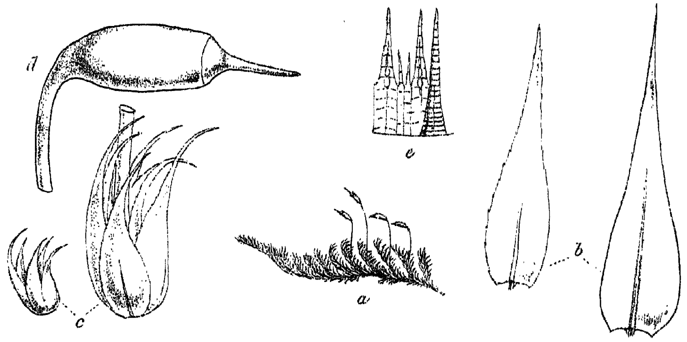


Leskea spinosa.

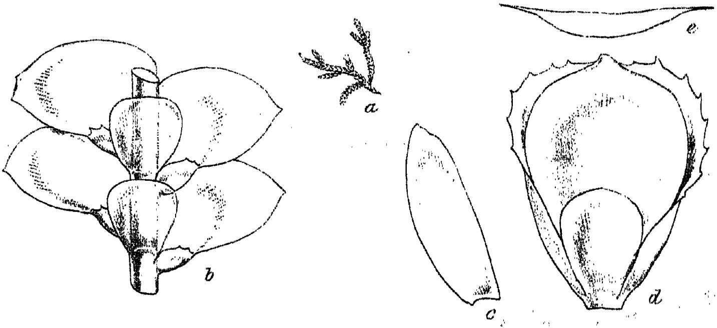


L. prolixa.

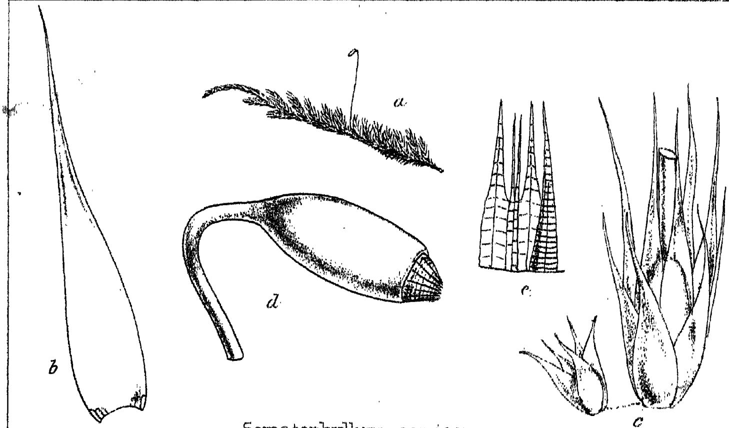
Mitten del. Fitch lith.



Hypnum surrectum.

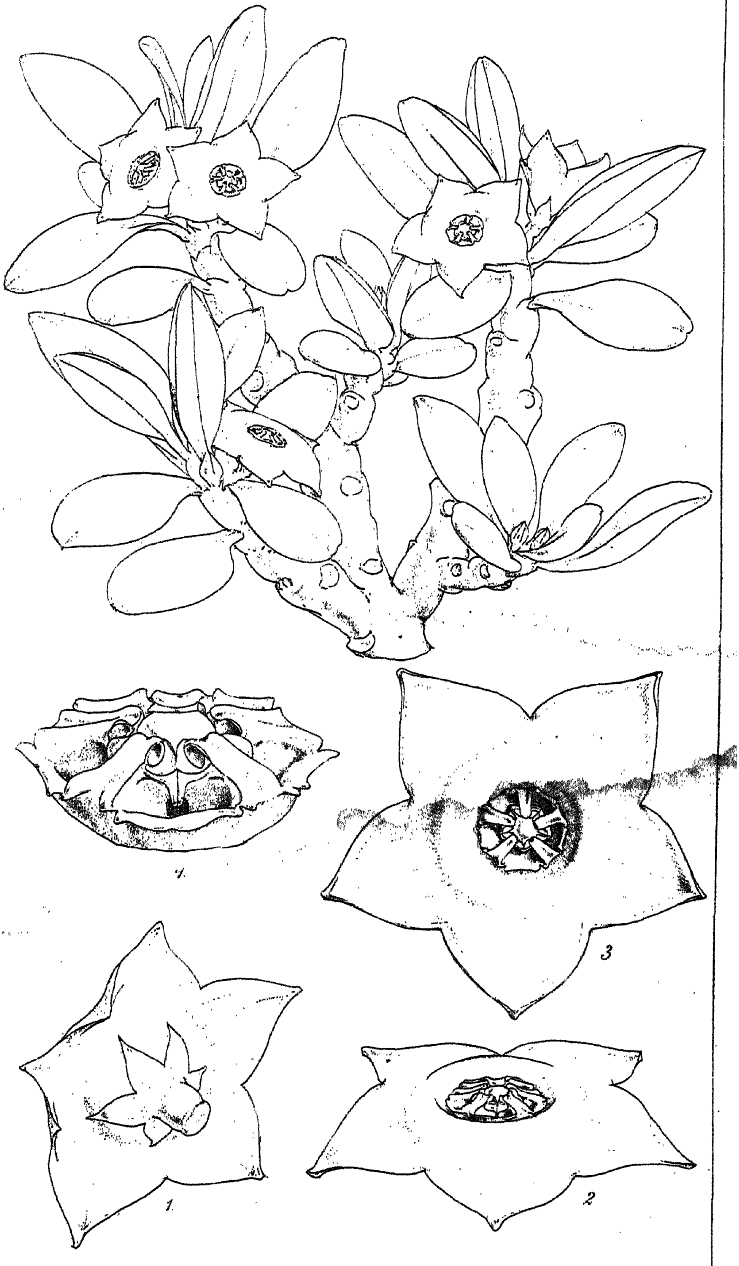


Lejeunia Johnsoniana.



Sematophyllum auricomum.

W. Fitch, del. et lith.
Vincent Brooks, Imp.



Frerea indica, *Dalz.*

the gland connecting them being of a bright ruby colour. The whole central part is like a little gem—a pearl set round with small rubies.

In the structure of its flower it comes nearest to *Boucerosia*, but differs in its perfectly rotate corolla, while in habit and appearance it is far removed from *Stapelia*, *Boucerosia*, and *Caralluma*. It approaches in habit to some Euphorbias, having a miniature resemblance to *E. nivulia*, barring the thorns. I dedicate this genus to Sir H. B. E. Frere, not only as a mark of esteem and respect, but also because he always has been the enlightened encourager and promoter of scientific researches in India, and is himself a close observer of nature.

## EXPLANATION OF PLATE III.

Fig. 1. Flower from behind, showing calyx.
2. Flower viewed laterally.
3. Flower viewed from above.
4. Corona and stigma. All magnified.

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# Description of a New Genus of *Scrophularineæ* from Martaban.

By Dr. J. D. HOOKER and Dr. T. THOMSON.

[Read March 3, 1864.]

[PLATE IV.]

## BRANDISIA.

*Calyx* campanulatus, 5-costatus, subæqualiter 5(-7)-dentatus. *Corolla* infundibuliformis, bilabiata; labio postico exteriore magno, concavo, obtuso, subtruncato, integro; antico trilobo, segmentis subæqualibus. *Stamina* 4, tubo corollæ prope basin affixa, didynama, adscendentia, subexserta, quinti rudimento 0. *Filamenta* glabra; *antheræ* rotundatæ, biloculares, loculis superne confluentibus, antice et margine longe pilosæ, dorso glabræ. *Ovarium* biloculare, placentis in loculos porrectis multiovulatis. *Stylus* elongatus, filiformis, glaber, superne subclavatus, integer, apice minute stigmatosus. *Ovula* ∞, lineari-oblonga, tenuia.—*Frutex* scandens vel sarmentosus, oppositifolius. *Flores* axillares, solitarii, pedicellis bibracteolatis.

**B. DISCOLOR**, *H. f. et T.* Ramuli elongati, graciles, rotundati, fusco-tomentosi. Folia oblongo-lanceolata, 2-3 poll. longa, 1-1½ lata, petiolo ¼-poll., subcoriacea, juniora utrinque dense floccoso-tomentosa, pilis stellatis; adulta superne, costa excepta, glabra, atro-viridia, siccitate atrata, subtus cum petiolo tomentosa. Pedicelli vix pollicares, cum calyce dense tomentosi, supra medium bracteolis 2 linearibus muniti. Calycis dentes basi lati, subtriangulares, tubo ½ breviores, normaliter 5, sæpe 6 vel 7. Corolla pollicaris, extus fusco-tomentosa, ima basi glabra, tubo intus glabro, limbo utrinque pubescente. Ovarium dense tomentosum. Stylus glaber.

We dedicate this very interesting genus to its discoverer, Dr. Brandis, the head of the forest-department in Pegu, an excellent botanist, who has made extensive and most valuable collections in the forests under his charge.

The general appearance of the plant is so little like Scrophularineæ, that it was only after examining the ovary that we were induced to place it there. The aspect of *Brandisia* is so very Verbenaceous, that we placed it in that family till we ascertained that it was many-ovuled. The order can, in fact, only be approximately determined, as the dehiscence of the fruit and the structure of the seed are unknown. If the seeds be exalbuminous, it will go to Bignoniaceæ; but the ovary and placentation are so much like Scrophularineæ, that in all probability albumen will be found in the seeds.

The position of *Brandisia* among Scrophularineæ, as Mr. Bentham has kindly pointed out, is probably among *Cheloneæ*, the only tribe in which large woody climbing plants occur. The flowers, though solitary, have two opposite bracteoles on the pedicel, and the curiously elongate ovules probably become winged seeds like those of *Wightia*.

### EXPLANATION OF PLATE IV.

Fig. 1. Peduncle and flower.
2. Corolla laid open.
3. Back and front of anther.
4. Pistil.
5. Transverse section of ovary.
6. Peduncle and young fruit.

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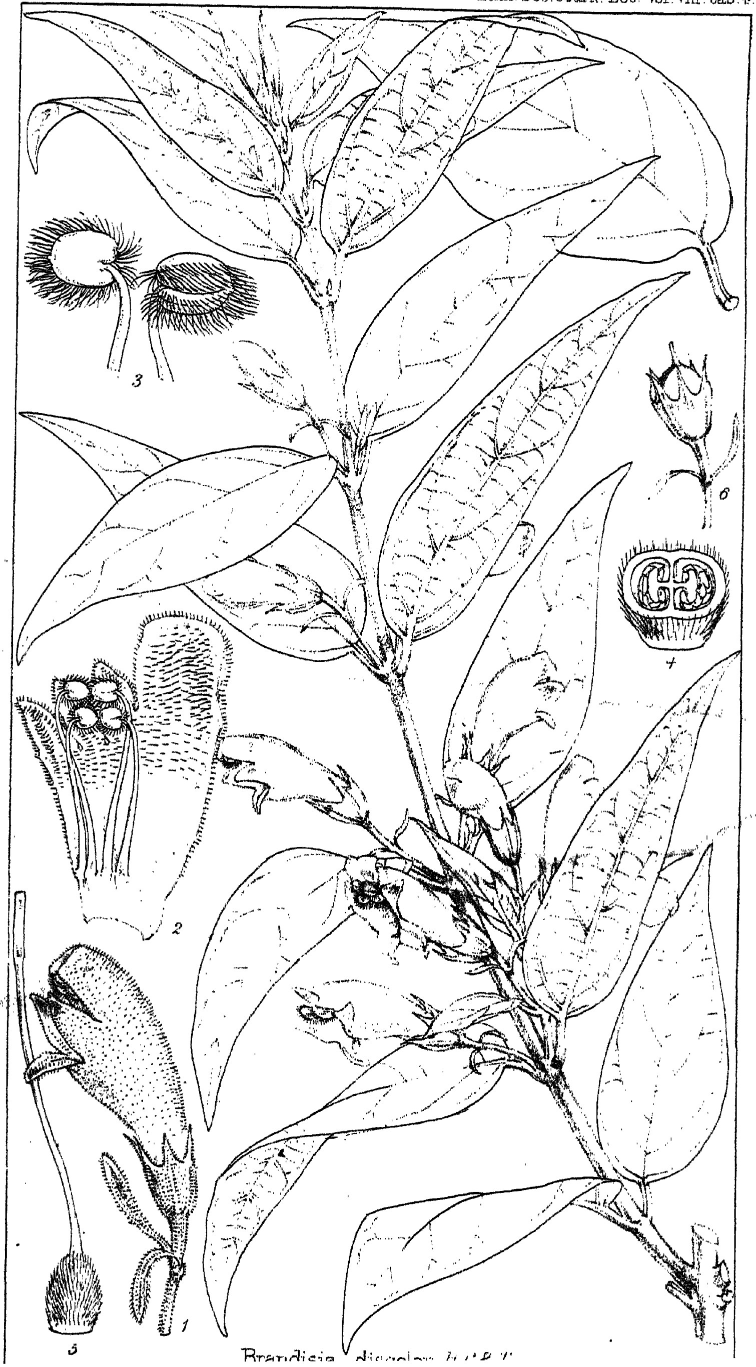
## The "Bryologia" of the Survey of the 49th Parallel of Latitude.

By William Mitten, A.L.S.

[Read Jan. 22, 1864.]

[Plates V.—VIII.]

The Mosses collected during the expeditions for the survey of the 49th Parallel owe their principal interest to the specimen



Brandisia discolor *H.f.& T.*

gathered by Dr. Lyall on the west side of the Rocky Mountains and in Vancouver Island, and these contain certain species which appear to be peculiar to that region, all the species from the country on the east side of the Rocky Mountains having been previously gathered by Drummond. Considering the vast extent of British America with regard to the specimens in herbaria, it becomes at once evident that but very little is yet known of its Moss-flora beyond the fact that it is very nearly identical with that of the north of Europe, and, so far as known, with but few peculiar species. A great gap exists in British herbaria in the almost entire absence of collections from all that extensive tract of country between Davis's Straits, Hudson's Bay, and Nova Scotia; and as this includes a great extent of regions subject to marine influences, it must be expected to produce a very extensive series of species.

In the United States, chiefly owing to the zealous labours of Sullivant, the knowledge of the productions of the parts investigated by him and his coadjutors has been greatly increased; but the country is so extensive, and there remains such an unexplored region in the south, where the northern forms become exchanged for those of tropical regions, which may probably be better observed there than anywhere else, that it is to be expected that great additions have yet to be made before the Bryology of the United States is approximately exhausted. Besides the species actually collected during the survey, there have been added a few others, either overlooked or not before determined, mostly collected by Drummond.

The arrangement of the species contained in the following enumeration is different from that employed in the 'Musci Indici,' in which the pleurocarpous genera were arranged approximately in the order in which the substance of the leaves became more and more indurated and obscure; and the whole of the Hypnoid mosses were divided into two sections by the nerves of the leaves, those with a single nerve being considered species of *Hypnum*, and those with two nerves or more were referred to Bridel's *Stereodon*. But although this plan serves very well to break up the tribe into two sections, there occur here and there species which may sometimes answer to one and sometimes to the requirements of the other section; examples of this occur in the species grouped in *Limnobium*, Schimper, in *Isothecium*, and in *Hylocomium*, and are probably overlooked in many species; for in some the leaves of the main stem are faintly two-nerved, and strongly one-nerved in the ultimate ramuli. Notwithstanding, however, the difficulty of defining the distinctions between the groups of Hypnoid mosses, Bridel's original group *Stereodon*, although incompletely viewed by him, may be said to differ from the *Hypna* of his arrangement in the more cylindric, less indurated capsule and short operculum, and in the habit of the species being somewhat different, the apices of the stems not usually descending and rooting in a proliferous manner as is the case with the *Hypna*. The mode of growth of the greater number of mosses is very little understood; for the comparison of a number of plants of the more abundant species, such as *Hypnum rutabulum*, Linn., will show that the habit assigned to *Rhynchostegium*, *Eurynchium*, and *Scleropodium* of Schimper is found in that species as well, and that the stem may be rooting its whole length, or erect and arcuate, or even subdendroid; and as all are equally fertile, one cannot be said to be less perfect than another. In the group *Stereodon* a number of aquatic species become erect in their mode of growth, from, as it would appear, their inability to increase in any other direction from the crowding of the stems together. In the 'Musci Indici' there was confused with the section *Stereodon* all that extensive group of species, chiefly tropical, which have distinct alar cells, generally three more distinctly conspicuous in each angle of the leaf, and a rostrate operculum; and these form another section or genus, *Sematophyllum*, which passes through a number of forms analogous to those of *Hypnum* and *Stereodon*.

In all arrangements of the Order Musci, up to the latest in M. Schimper's Synopsis (1860), the peristome is taken as the chief distinguishing character, and genera have been founded, and are maintained, upon characters dependent upon differences of which the value has been greatly overestimated; and even the straightness or curvature of the capsule is considered sufficient to constitute a distinct genus, and thus species are removed from proximity to those to which in every other particular they are so intimately allied as to be, in several cases, almost undistinguishable. Prominent examples of this occur in the *Trichostoma* as here understood, in which there is a regularly ascending series from *Pottia* through *Anacalypta* into *Desmatodon*; and as all these stages of development do occasionally occur in specimens of the same species, the conclusion seems unavoidable that the definition of a single genus should be sufficiently wide to contain them all. Very nearly the same position is occupied by the species of the genus *Trichostomum* allied to *T. flavovirens* in respect of *Tortula*: taking for the typical species *T. tortuosa*, the only difference is in the shorter teeth of the peristome, the structure being identical. The same analogies exist in the development of the peristome of the pleurocarpous mosses, as, for example, in the capsule and peristome of the so-called genera *Homalothecium* and *Camptothecium*. In the species contained in these genera, the resemblance between the plants without the fruit is so great that it requires an expert bryologist to distinguish them from each other. The same is the case with *Pylaiesia*, which without fruit or inflorescence could hardly be known from *Hypnum cupressiforme*. It would seem, therefore, that a natural group of Mosses can only be defined from the structure of the species in which the highest development is found. All those species which agree in all other respects, as habit, ramification, position of the fruit, form, and substance of the leaves, but present a less development of peristome, should be considered as only affording a negative difference, of barely specific value. There would appear to be no escape from this conclusion among the acrocarpous genera; and as there is no difference in the structure of the peristome in the pleurocarpous, it must be applicable to the whole group of Arthrodontoid mosses.

## MUSCI.

### DICRANACEÆ, *Mitten, Musci Ind.*

### CYNODONTIUM, *Hedw.*

(*Distichium*, B. et S.)

C. CAPILLACEUM, *Hedw.*
*Hab.* Near Fort Ellice, Saskatchewan, and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

C. INCLINATUM, *Hedw.*
*Hab.* Saskatchewan, *Bourgeau.*

(*Leptotrichum*, Hampe.)

C. FLEXICAULE, *Schw.*
*Hab.* Cascade Mountains, *Lyall.*

(*Dicranella*, Schimp.)

C. CRISPUM, (Dicranum) *Hedw.*
*Hab.* Galton Mountains, *Lyall.*

C. SUBULATUM, (Dicranum) *Hedw.*
*Hab.* Galton Mountains, *Lyall.*

C. HETEROMALLUM, (Dicranum) *Hedw.*
*Hab.* Cascade Mountains, *Lyall.*

The genus *Cynodontium* of Hedwig, as described in the 'Species Muscorum,' contains, besides *C. capillaceum* and *C. inclinatum*, two other species which have long since been removed to other genera; and although *Distichium*, applied by Schimper to the two species with distichous leaves, is more expressive so far as relates to them in particular, yet it seems hardly possible to maintain a genus solely on this character, much less a natural family *Distichiæ*, when there is no appreciable difference in form or structure from the species allied to *Cynodontium flexicaule*, Schw., and the numerous species which agree with it in structure and habit. These, separated by Hampe from the other mosses usually referred to the genus *Trichostomum*, have been of late placed in the genus *Leptotrichum*, Hampe; recently, however, it has been pointed out by Lindberg that this name was already in use for a genus of Fungi, and he proposed instead of *Leptotrichum* the name *Diaphanophyllum*, Lindbg.; but on looking back in the history of the species it would appear that there is no reason why Hedwig's genus, considered as it must have been by Schwägrichen when he added *C. flexicaule* to it, should not be reinstated. The generic name *Trichostomum*, under which a number of species referable to *Cynodontium* have been arranged, cannot be employed, for reasons which will be stated elsewhere. If it be granted that the *Dicranaceæ* are a group of species of which the genus *Dicranum* is the typical form, and which may contain a series of progressive developments from *Archidium* through *Pleuridium*, *Bruchia*, *Garckea*, into *Cynodontium*, the place of the last-named genus must be very close to *Dicranum*, and its only difference the absence of distinct alar cells. No generically distinctive character can be drawn from the peristome, which in point of structure is alike in all the species of the family, and attains its highest known development in *Dicranum*. The structure of the leaves is nearly the same in all, excepting in the genera *Didymodon* and *Holomitrium*, in which the cells become shortened in the upper portions and thus approach to the *Trichostoma*. The aggregation of the cleistocarpous genera *Archidium* and *Pleuridium* in the same group of genera with *Dicranum* is a breaking up of the old idea of a separate family for the Phascoid mosses; but it may be observed that the sole difference between *Pleuridium* and *Cynodontium* is the absence of a deciduous operculum; and that all the other Phascoid genera are referable to other more highly developed families is evident from the close affinity among those belonging to the *Trichostoma*.

Overlooked amongst Drummond's specimens is

C. CANADENSE. Dioicum?, caule brevi simplici, foliis e basi erecta subquadrata superne latiore vaginante subulato-lanceolatis divaricatis, nervo percurrente valido, marginibus serrulatis, cellulis basi elongatis inde suboblongis marginalibus brevioribus omnibus pellucidis, perichætialibus parum majoribus conformibus, theca in pedunculo elongato rubro turbinata inæquali, ore magno, dentibus validis rubris dicranis.

*Hab.* British N. America (probably from the Rocky Mountains), *Drummond*, no. 101 part.

In colour and appearance like a small state of *C. squarrosum*, (*Dicranum*) Schrad. Stems two or three lines high; seta about half an inch long or more. The leaves are pellucid, and differ from those of *C. squarrosum* in the more subulate narrower points and serrulate margins. This forms the third known species, corresponding closely with *C. squarrosum*—the Indian *C. patulum*, (*Leptotrichum*) Mitten, having leaves of the same outline, but serrulate, and, so far as can be seen, it is of a smaller size.

No species of *Archidium* has yet been noticed from British North America. Several occur in the United States, and the following appears to have escaped notice.

### ARCHIDIUM, *Brid.*

A. TENERRIMUM. Foliis lanceolatis subserratis nervo excurrente, cellulis elongatis laxis, perichætialibus e basi ovali subulato-lanceolatis, florescentia fructuque *A. phascoidis*.

*Hab.* Louisiana, *Drummond*, 2. no. 11 (as *A. phascoides*).

In the decidedly excurrent nerve and very lax areolation of the leaves this species is certainly distinct from *A. phascoides*, Brid. *A. Ohioense*, Sullivant, to which it is also closely allied in habit and general appearance as well as in the excurrent nerve, has its antheridia in distinct flowers, and the cells of its leaves not quite half so long and more close and firm.

### DICRANUM, *Hedw.*

D. STRICTUM, *Schleich.*

*Hab.* Fort Colville, *Lyall*. Gathered also in British America by *Drummond*; Lake Huron, *Todd*; and in the United States by *Cooley*, and near Boston, *Green*. It is not enumerated by Sullivant.

D. FLAGELLARE, *Hedw.*

*Hab.* Fort Pitt, Saskatchewan, *Bourgeau*.

D. FUSCESCENS, *Turner.*
*Hab.* Cascade Mountains and Galton Mountains, *Lyall*; Winnipeg, *Bourgeau.*

D. PALLIDUM, *B. et S.*
*Hab.* British Columbia, *Lyall.* Gathered also in N.W. America by *Douglas* and *Seemann.* It appears to be generally distributed in N. America.

D. SCOPARIUM (*Linn.*).
*Hab.* British Columbia, *Lyall*; N.W. America, *Seemann*; Columbia, *Douglas.* It occurs as far north as Baffin's Bay, but according to Sullivant is less common than the preceding in the United States.

D. PALUSTRE, *La Pyl.*
*Hab.* Pend Oreille River and Semihamoo Bay, *Lyall*; Vancouver Island, *Wood*; Lake Winnipeg, *Bourgeau.* Generally distributed.

D. UNDULATUM, *Turner.* D. polysetum, *Sw.*
*Hab.* Saskatchewan, *Bourgeau.*

D. DRUMMONDII, *C. Müller.*
*Hab.* Saskatchewan and Portage de la Prairie, Lake Winnipeg, *Bourgeau.*

D. SCHRADERI, *Schw.*
*Hab.* Saskatchewan, *Bourgeau.*

D. LONGIFOLIUM, *Hedw.*
*Hab.* Portage de la Prêle, Lake Winnipeg, *Bourgeau.*

*D. enerve*, Thed. (*D. albicans*, B. et S.), was gathered by Douglas in N.W. America.

### HOLOMITRIUM, *Brid.*

H. CIRRHATUM, (Weissia) *Hedw.*
*Hab.* Vancouver Island and British Columbia, *Lyall.* Collected *Douglas* in N.W. America.

H. CRISPULUM, (Weissia) *Hedw.*
*Hab.* Galton Mountains and near Fort Colville, *Lyall.*

### DIDYMODON, *Hedw.*

### (*Amphoridium*, Schimp.)

D. LAPPONICUS, (Gymnostomum) *Hedw.*
*Hab.* Cascade Mountains, *Lyall.*

D. CÆSPITOSUS, sp. nov. *D. Mougeotii* habitu staturaque simillimus, foliis e basi erecta patentibus apice incurvo erectis sensim acutis remote serrulatis, cellulis basi oblongis rectangulatis, deinde in ovoideas et superne in rotundatas transeuntibus.
*Hab.* Vancouver Island, *Lyall.*

In pale-green tufts, to all external appearance like *D. Mougeotii*, (*Amphoridium*) Schimp., but leaves gradually narrowed into an acute point, and the margin remotely serrulate as in *D. cyathicarpus*, (*Zygodon*) Mont.; the cells of the base of the leaf are not linear and narrow as in that species.

All the above-named species are regarded by me as imperfectly peristomate forms of *Rhabdoweissia*, Schimp., which is itself composed of species passing into the complete forms observable in *D. polycarpus*, *D. virens*, and *D. Wahlenbergii.*

(*Ceratodon*, Brid.)

D. PURPUREUS (*Linn.*).
*Hab.* Lake Winnipeg, *Bourgeau*; Cascade Mountains, British Columbia, and Vancouver Island, *Lyall.*

(*Oncophorus*, Brid.)

D. POLYCARPUS, (Dicranum) *Ehrh.*
*Hab.* Cascade Mountains, *Lyall*; Saskatchewan, *Bourgeau.*

D. VIRENS, (Dicranum) *Hedw.*
*Hab.* Galton Mountains, alt. 6000–7000 feet; British Columbia, *Lyall.*

D. WAHLENBERGII, *Brid.*
*Hab.* Saskatchewan, *Bourgeau.*

No species of *Didymodon* of the section *Leptodontium*, Hampe, has yet been received from British N. America; but the *Syrrhopodon excelsus*, Sullivant, referred by Müller to *Zygodon*, appears to be a slender state of a species which has been sent in a fertile state from Mexico, and corresponds nearly with the description of *Trichostomum ulocalyx*, C. Müller.

## GRIMMIACEÆ.

### GRIMMIA, *Ehrh.*

(*Scouleria*, Hook.)

G. SCOULERI, *C. Müller.*
*Hab.* On stones in the Columbia River, Fort Colville, *Lyall.*

(*Schistidium*, Brid.)

G. APOCARPA (*Linn.*).
*Hab.* Rocky Mountains, *Bourgeau*; Cascade Mountains and Fort Colville, *Lyall*; N.W. America, *Douglas.*

Generally distributed in British N. America; and from the numerous specimens brought by Mr. Taylor from Davis's Straits, it would appear to be abundant in that region. Amongst his specimens there occurred a few of what appears to be a different species:—

G. PLATYPHYLLA. Foliis incurvis imbricatis late ovatis apice obtusis apiculove brevi diaphano terminatis marginibus revolutis nervo in apice evanido, foliis perichætialibus late ovali-oblongis apice obtuse angulatis, cellulis elongatis teneris fere ad apicem usque areolatis, theca immersa; cætera *G. apocarpæ* similis.

*Hab.* Davis's Straits, *Taylor.*

In habit, colour, and general appearance agreeing with *G. apocarpa*, var. *stricta*; but its leaves are more than twice as wide, and both in the wet and dry state imbricated; in their substance and areolation they agree exactly with those of *G. apocarpa*, and the capsule and peristome appear precisely the same; the perichætial leaves are very laxly areolate for two-thirds of their length. The specimens, from their very wide leaves, are immediately distinguishable from all known varieties of *G. apocarpa.*

### (*Eugrimmia*, C. Müller.)

G. LEUCOPHÆA, *Grev.*

*Hab.* Fort Colville, *Lyall.*

Rather more slender than European specimens.

G. ALPESTRIS, *Schleich.*

*Hab.* Fort Colville and Pend Oreille River, *Lyall.*

All the specimens very dark green, but not otherwise differing from European ones.

G. PULVINATA (*Linn.*).

*Hab.* Fort Colville, *Lyall.*

G. TRICHOPHYLLA, *Grev.*

*Hab.* Vancouver Island, *Lyall.*

G. PATENS, (Bryum) *Dicks.*

*Hab.* Between Fort Colville and the Rocky Mountains, *Lyall.*

### (*Dryptodon*, Brid.)

G. ACICULARIS, *Linn.*

*Hab.* British Columbia, *Lyall and Douglas.*

The capsule in some specimens elongated; but in other particulars like the European moss.

### (*Rhacomitrium*, Brid.)

G. HETEROSTICHA, (Trichostomum) *Hedw.*

*Hab.* Fort Colville and Pend Oreille River, *Lyall.*

G. VARIA, sp. nov. *G. fasciculari* simillima, sed major, foliis ovato-lanceolatis apice obtusis vel (superioribus) pilo brevi subintegerrimo, nervo percurrente, marginibus recurvis, cellulis basi ad latera paucis oblongis rectangulatis interioribus elongatis confluentibus crenulatis supra folii medium oblongis parietibus transversis distinctioribus supremis quadrato-rotundatis, perichætialibus brevibus late ovatis convolutis, theca in pedunculo elongato cylindracea nitida, operculo subulato subæquilongo, peristomio dentibus rubris prælongis angustis.
*Hab.* British Columbia, *Lyall and Douglas*; and also in Observatory Inlet.

Much more robust than *G. fascicularis*, and with short diaphanous points on some of its upper leaves. The leaves are below of an oblong-ovate form, the upper third constituting the lanceolate point; in this particular they are intermediate in outline between those of *G. fascicularis* and *G. canescens*, wanting, however, the laxly areolate auricles at the base in the latter. This moss needs further observation; but it can scarcely be considered a form of *G. fascicularis*.

G. CANESCENS (*Dill.*).
*Hab.* Vancouver Island, *Lyall.*

G. LANUGINOSA, *Dill.*
*Hab.* Vancouver Island, *Wood.*

No species of *Glyphomitrium*, Bridel, has yet been received from British Columbia; but amongst Drummond's incomplete specimens there occurs a small species which has never been described.

### GLYPHOMITRIUM, *Brid.*

G. CANADENSE, sp. nov. Monoicum, humile, foliis lanceolatis sensim acutis, margine inferne recurvo, cellulis basi oblongis ad angulos angustatis inde in rotundas transeuntibus, perichætialibus latissime ovatis convolutis breviter apiculatis, theca in pedunculo bilineari ovali, calyptra apice rugosa, habitu *G. Daviesii* simillimum.
*Hab.* British N. America, *Drummond.*

The oval capsule and different areolation of the leaves readily distinguish this from *G. Daviesii*, which in size and appearance it much resembles. The operculum and peristome are absent.

## BARTRAMIACEÆ, *Mitten.*

### PHILONOTIS, *Brid.*

P. FONTANA, *Linn.*
*Hab.* Rocky Mountains, *Bourgeau*; Chilukweyuk and Fort Colville, *Lyall.*

### BARTRAMIA, *Hedw.*

**B. MENZIESII**, *Turner*.
*Hab.* Vancouver Island, *Lyall*.

**B. POMIFORMIS** (*Linn.*).
*Hab.* Pend Oreille River and Sumass Prairie, *Lyall*.

**B. ITHYPHYLLA**, *Brid.*
*Hab.* Cascade Mountains and Rocky Mountains, *Lyall*.

**B. ŒDERI** (*Gunn.*). B. gracilis, *Schw.*
*Hab.* British Columbia near the 49th parallel, *Lyall*.

### MEESIA, *Hedw.*

**M. ULIGINOSA**, *Hedw.*
*Hab.* Mooyie River (a branch of the Kootenay), *Lyall*.

**M. TRISTICHA**, *Funk.*
*Hab.* Pack River, *Lyall*.

## FUNARIACEÆ, *Mitten.*

### FUNARIA, *Schreb.*

**F. HYGROMETRICA** (*Linn.*).
*Hab.* Saskatchewan, *Bourgeau*; Fort Colville, Sinyakwateen, and Vancouver Island, *Lyall*.

## SPLACHNACEÆ, *Mitten.*

### TAYLORIA, *Hook.*

**T. SERRATA**, (Splachnum) *Hedw.*
*Hab.* Fort Colville, *Lyall*.

*Splachnum melanocaulon*, Schw., has been several times brought from Western N. America; and some specimens collected on the Rocky Mountains by Mr. Burke show an extraordinary variation in the capsules, which in some specimens are as figured by Schwägrichen, and in others varying in the length of the seta until the capsule is only just exserted beyond the leaves, and with or without an umbraculum.

## BRYACEÆ, *Mitten.*

### WEBERA, *Hedw.*

**W. NUTANS**, (Bryum) *Schreb.*
*Hab.* Saskatchewan, *Bourgeau*; Cascade Mountains and Galton Mountains, *Lyall*.

**W. CRUDA**, (Bryum) *Schreb.*
*Hab.* Fort Colville and Cascade Mountains, *Lyall*.

W. LONGICOLLA, (Bryum) *Sw.*
*Hab.* Cascade Mountains, *Lyall.*

W. ALBICANS, *Wahl.*
*Hab.* Galton Mountains, *Lyall.*

W. LUDWIGII, (Bryum) *Spreng.*
*Hab.* Cascade Mountains, *Lyall.*

W. PYRIFORMIS (*Linn.*).
*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

### BRYUM, *Dill.*

B. ARCTICUM, (Pohlia) *Brown.*
*Hab.* Rocky Mountains, *Bourgeau.*

B. PURPURASCENS, (Pohlia) *Brown.*
*Hab.* Rocky Mountains, *Bourgeau.*

B. ULIGINOSUM, *B. et S.*
*Hab.* Rocky Mountains, *Bourgeau.*

B. BROWNII, *B. et S.*
*Hab.* Rocky Mountains, *Bourgeau.*

B. CÆSPITICIUM, *Linn.*
*Hab.* Saskatchewan, *Bourgeau*; Pack River, Cascade Mountains, Kettle Falls, and Galton Mountains, *Lyall.*

B. PALLESCENS, *Schleich.*
*Hab.* Cascade Mountains, *Lyall.*

B. BIMUM, *Schreb.*
*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall.*

B. PSEUDOTRIQUETRUM, *Hedw.*
*Hab.* Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall.*

B. DUVALII, *Voit.*
*Hab.* Fort Colville, *Lyall.*

B. TURBINATUM, *Hedw.*
*Hab.* Galton Mountains, *Lyall.*

B. CAPILLARE, *Linn.*
*Hab.* Vancouver Island, Pack River, and Galton Mountains, *Lyall.*

B. ARGENTEUM, *Linn.*
*Hab.* Rocky Mountains, *Bourgeau.*

## ORTHOTRICHACEÆ, *Mitten.*

### ORTHOTRICHUM, *Hedw.*

O. PALLENS, *Bruch.*
*Hab.* Pack River, British Columbia, *Lyall.*

O. STRANGULATUM, *Beauv.*
*Hab.* Cascade Mountains, British Columbia, *Lyall.*

O. ANOMALUM, *Hedw.*
*Hab.* Saskatchewan, *Bourgeau.*

O. SPECIOSUM, *Nees.*
*Hab.* On rocks near Fort Colville, *Lyall.*

O. ELEGANS, *Schw.*
*Hab.* Pend Oreille River, and between that and Kootenay River, British Columbia, *Lyall.*

The smooth capsule and rather more slender habit seem to be the only differences between this and the preceding; both forms are found in Europe.

Very large specimens of what appears to be the same as the European *O. Lyellii*, Hook., were gathered by Menzies on the N.W. coast of America, and were marked by Sir W. Hooker "*O. Menziesii*," but were never published; there is a great difference in the external look of the specimens, but no appreciable distinction.

O. CONSIMILE. Monoicum, pulvinatum, humile, foliis patentibus e basi ad insertionem angusta inde dilatatis ovato-lanceolatis nervo carinatis, marginibus recurvis reflexisve, cellulis basi paucis oblongis quadratisque superioribus rotundatis, perichætialibus conformibus, theca in pedunculo brevi exserta ovali siccitate plicata, operculo conico acuminato brevirostro, peristomio dentibus 8, ciliis simplicibus æquilongis 8 interpositis, calyptra plicata ramentosa.
*Hab.* Vancouver Island, on trees, *Lyall.*

Closely resembling *O. Columbicum*, but with shorter leaves. It is also allied to *O. pulchellum*, Sm., a species of which the position has not been well understood, it being sometimes placed in *Ulota*; but it agrees with the smaller species which correspond nearly with *O. speciosum*, Nees, and is truly an *Orthotrichum.*

O. COLUMBICUM. Monoicum, pulvinatum, humile, foliis e basi brevi oblonga erectiore longe lanceolatis patentibus apice latiuscule acutis nervo percurrente carinatis, marginibus reflexis, cellulis basi paucis elongatis superioribus subrotundis, perichætialibus brevibus, theca in pedunculo brevi exserta ovali-cylindracea siccitate plicata, peristomio dentibus 8, ciliis æquilongis 8 simplicibus alternantibus, calyptra plicata apice rugosa nuda.
*Hab.* Vancouver Island, on trees, *Lyall.*

In general appearance similar to *O. Tasmanicum*, Hook. f. et Wils., but rather less.

Amongst the American *Orthotricha* there occur several species which appear to have been overlooked, or to have been passed over as states of European species, but which on comparison do not appear to be identical with any previously known; of these are—

O. PARVULUM. Monoicum, humillimum, foliis patentibus elliptico-lanceolatis sensim acutis acutatis acuminatisque nervo carinatis, marginibus vix recurvis, cellulis basi ad angulos alares paucis oblongis fuscis, cæteris omnibus rotundatis, perichætialibus basi latioribus, theca immersa obovata plicata, peristomio dentibus 16, calyptra plicata ramentosa.—*O. Sturmii*, Sullivant.

*Hab.* Prope Santa Fe Neo-Mexicanorum, *Wright*, et in Novæ Angliæ alpibus, *Oakes*.

Very different from *O. Sturmii*, Hsch. et Hoppe, and in its foliage more like *O. tenellum*, Bruch.

O. PUSILLUM. Monoicum, brevissimum, foliis patentibus ovato-lanceolatis, inferioribus acutis, superioribus late acutatis obtusiusculis nervo carinatis, marginibus reflexis, cellulis basi quadratis pellucidis, superioribus rotundatis granulosis, perichætialibus interioribus brevioribus, theca immersa obovata siccitate 8-plicata leptoderma, peristomio dentibus 16 brevibus.

*Hab.* Pennsylvania, *Drummond.*

Less than *O. tenellum*, and with a very thin, short, pale capsule, and foliage more rigid than in *O. parvulum*.

O. COULTERI, sp. nov. Monoicum, habitu staturaque *O. tenelli*, foliis densis e basi erectiore subovali angustatis lanceolatis patentibus, apicibus latiusculis obtusiusculis subacutis, marginibus recurvis, nervo sub apice evanido carinatis, cellulis basi in folii medio paucis oblongis elongatisque latioribus, inde ad apicem abbreviatis quadratis rotundisque distinctis papillosis, perichætialibus erectioribus latioribus elliptico-lanceolatis acutioribus, vaginula ramentis elongatis pilosa, theca emersa ovali-cylindracea octies plicata in pedunculo sensim angustato, peristomio dentibus ciliisque tertia parte brevioribus angustis 8, calyptra ramentis brevibus appressis obtecta.

*Hab.* California, *Coulter*.

Very similar in appearance to *O. tenellum*, Bruch, but its capsules exserted beyond the apices of the perichætial leaves, which are more acute, its calyptra more pilose, its cilia short, and its male flowers larger.

The description of *O. cylindrocarpum*, Lesq., in which the peristome is stated to be "dentibus externis pallidis, ciliolis robustis longioribus albidis articulatis," and the calyptra "valde pilosa," indicates another nearly allied Californian species.

O. CANUM. Humile, foliis patentibus elliptico-lanceolatis nervo carinatis, marginibus recurvis reflexisve, apicem versus plus minus erosulis apice diaphanis, superioribus pilo brevi hyalino fragili terminatis, cellulis basi paucis oblongis quadratisque, inde ad apicem rotundatis granulosis grossiusculis, perichætialibus ovatis subacutis, theca emergente ovali-cylindracea plicata, operculo breviter acuminato, peristomio dentibus bigeminatis ciliis subulatis basi e serie duplici cellularum compositis interpositis, calyptra totam fere thecæ obtegente breviter ramentosa.

*Hab.* British N. America, *Drummond.*

Different from *O. diaphanum*, Schrad., in the form of its leaves, and in appearance more nearly like *O. pumilum*, Schw., which has differently shaped r le [illegible] s, also tipped with a minute hyaline fragile mucro.

### ULOTA, *Brid.*

U. PHYLLANTHA, *Brid.*

*Hab.* Vancouver Island, *Wood.*

U. AMERICANA. Monoica, foliis siccitate tortis appressis e basi subovali longe lanceolatis sensim acutis nervo carinatis, marginibus recurvis, sæpe suberosis, cellulis basi ad margines seriebus circiter tribus hyalinis oblongis, in medio angustis luteis, superioribus rotundatis diametro circiter $\frac{1}{4000}$ unciæ metientibus, perichætialibus apice latioribus obtusiusculis, theca elliptica plicata, operculo conico acuminato, peristomio dentibus bigeminatis 8, ciliis æquilongis angustis 8, calyptra breviter appresse ramentosa.

*Hab.* Lake Huron, *Todd*; British N. America, *Drummond*, no. 153, with *U. Bruchii* as *U. crispa.*

Differs from *U. curvifolia*, Wahlenb., in the areolation of the base of the leaf, and from *U. crispa*, Hedw., and *U. crispula*, Hsch., in the same particular, as well as in the form of the base of the leaves. The space of a thousandth part of an inch in the middle of the lanceolate part of the leaves contains in *U. crispa* two cells, in *U. crispulum* two and a half, in *U. Americana* three cells.

U. BARCLAYI. Monoica, cæspitosa, humilis, foliis patentibus siccitate appressis e basi excavata subrotundata late lanceolatis acutis, superioribus acutatis, nervo carinatis, marginibus convexis integerrimis, cellulis basi ad lateras oblongis in seriebus pluribus hyalinis, interioribus paucis elongatis luteis, superioribus rotundatis diametro circiter $\frac{1}{5000}$ unciæ metientibus, perichætialibus ovato-lanceolatis convolutis erectis, theca ovali et collo crasso siccitate plicata, peristomio dentibus bigeminatis 8, ciliis 8 brevioribus interpositis, calyptra breviuscula breviter ramentosa.

*Hab.* Sitka, *Barclay.*

A very small pale yellowish species, in the older portions rusty. Unlike any other known North American *Ulota*, having the leaves scarcely twisted when dry, and the very thick peduncle, which is the elongated neck of the capsule, when dry plicate, as well as the capsule itself, which is pale brown.

## TRICHOSTOMACEÆ, *Mitten*.

### * *Tortulæ*.

### HYMENOSTYLIUM, *Brid.*

H. CURVIROSTRE, (Gymnostomum) *Hedw.*
*Hab.* Rocky Mountains, *Bourgeau.*

### BARBULA, *Hedw.*

B. RUBIGINOSA. Dioica, *B. vineali* habitu staturaque affinis, foliis siccitate appressis curvatis, humidis patentibus, inferioribus ovatis, superioribus e basi ovata ad insertionem angustata angulis decurrentibus subulato-lanceolatis acutis, margine recurvo, nervo in apicem crassiusculum percurrente, cellulis minutis rotundatis subobscuris minute papillosis, perichætialibus erectis majoribus e basi elongato-ovali turgide laxe convoluta nervo excurrente subulato-apiculatis, theca in pedunculo rubro ovali-cylindracea erecta, operculo conico dimidio breviore, annulo e triplici serie cellularum composito, peristomio nullo.
*Hab.* N.W. America, *Douglas.*

In the absence of peristome, allied to the East Indian *B. rufescens*; but the present is a rather larger species, with more subulate leaves, not so straight, and stiffly appressed when dry; they are also more contracted at the base.

B. RIGIDULA, (Bryum) *Dicks.*
*Hab.* Vancouver Island, *Lyall.*

The specimens are too old and too young to show the peristome, but they appear to belong to this species.

B. FALLAX, *Hedw.*
*Hab.* Rocky Mountains, *Bourgeau.*

A barren moss, but which appears to belong to this species.

*B. insulana*, De Notaris, usually confused with *B. vinealis*, Brid., was gathered in California by Beechey.

B. RUBELLA, *Roth.*
*Hab.* Rocky Mountains, *Bourgeau.*

### TORTULA, *Schreb.*

T. TORTUOSA, *Linn.*
*Hab.* Rocky Mountains, *Bourgeau.*

T. CORNICULATA, (Trichostomum) *Wahl.* Barbula anomala, *Bryol. Europ.*
*Hab.* Vancouver Island, *Lyall.*

One or two stems only; it was gathered in California by Dr. Coulter.

### ** *Syntrichiæ.*

### PHASCUM, *Linn.*

P. CUSPIDATUM, *Schreb.*
*Hab.* Fort Colville, *Lyall.*

### DESMATODON, *Brid.*

D. CAVIFOLIUS, (Pottia) *Ehrh.*
*Hab.* Fort Colville, *Lyall.*

D. HEIMII, (Gymnostomum) *Hedw.*
*Hab.* Saskatchewan, *Bourgeau.*

D. LATIFOLIUS, (Dicranum) *Hedw.*
*Hab.* Cascade Mountains, *Lyall.*

D. MUCRONIFOLIUS, (Tortula) *Schw.*
*Hab.* Rocky Mountains, *Bourgeau.*

### SYNTRICHIA, *Brid.*

S. PRINCEPS, *De Not.* Barbula Mülleri, *B. et S.*
*Hab.* Vancouver Island, *Lyall.*

Some of the specimens very fine, and much larger than European ones. This species is widely distributed, and in appearance is very variable.

If De Notaris's name has priority in publication, it ought to take precedence.

S. RURALIS, *Linn.*
*Hab.* Rocky Mountains, Cascade Mountains, Fort Colville, and Moyie River (a branch of the Kootenay), *Lyall.*

This species is generally present in collections from very high northern latitudes.

S. LÆVIPILA, *Brid.*
*Hab.* Vancouver Island, *Lyall.*

A short compact state, but not apparently different from the European form. M. Lesquereux makes the same remarks upon the Californian specimens sent to him.

*S. papillosa*, Wils., has been sent from Boston intermixed with *Pterogonium intricatum*, Hedw.

### ENCALYPTA, *Schreb.*

E. CILIATA, *Hedw.*
*Hab.* British Columbia, Cascade Mountains, and Fort Colville, *Lyall.*

E. VULGARIS, *Hedw.*
*Hab.* Fort Colville, *Lyall.*

E. RHABDOCARPA, *Schw.*
*Hab.* Rocky Mountains. Cascade Mountains, *Lyall.*

E. LONGIPES. Dioica?, caule brevi ramoso, foliis patulis concavis ambitu late ellipticis acutis paulo supra basin angustatis nervo percurrente obtuse carinatis, margine minute eroso, cellulis basi infima oblongis hyalinis inde viridibus mox abbreviatis quadrato-rotundatis papillosis, perichætialibus parvis vaginulam vix superantibus latissime ovatis acutis, theca in pedunculo longissimo rubro ovato-cylindracea basi apophysata, operculo subulato subæquilongo, peristomio dentibus angustis elongatis, calyptra basi nuda apice lævi.
*Hab.* In a shaded place by the side of a rivulet, Rocky Mountains, *Drummond.*

Stems about three lines high, with many fastigiate branches. Foliage like that of *E. streptocarpa*, to which species Drummond himself referred the specimens. Leaves gradually dilated from a little above the pale base, the upper portion broadly elliptic. Seta an inch and a half long, slightly flexuose. Capsule too immature to show if it is furrowed. Male flowers not seen.

## MNIACEÆ, *Mitten.*

### FISSIDENS, *Hedw.*

F. ADIANTOIDES (*Linn.*).
*Hab.* Fort Colville, *Lyall.*

F. GRANDIFRONS, *Brid.*
*Hab.* Sumass Prairie, British Columbia, *Lyall.*

### TETRAPHIS, *Hedw.*

T. PELLUCIDA (*Linn.*).
*Hab.* Saskatchewan, *Bourgeau*; Fort Colville, *Lyall.*

### AULACOMNION, *Schw.*

A. ANDROGYNUM (*Linn.*).
*Hab.* Vancouver Island and Fort Colville, *Lyall.*

A. PALUSTRE (*Linn.*).
*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

## MNIUM, *Linn.*

M. INSIGNE, *Mitten.*
*Hab.* Vancouver Island, *Wood and Lyall*; British Columbia, *Lyall.*

M. MEDIUM, *B. et S.*
*Hab.* Pend Oreille and Pack Rivers, Fort Colville, and Cascade Mountains, *Lyall.*

M. AFFINE, *Bland.*
*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau.*

M. VENUSTUM, *Mitten.*
*Hab.* Vancouver Island, *Lyall.*

M. CUSPIDATUM, *Hedw.*
*Hab.* Saskatchewan, *Bourgeau.*

M. SPINULOSUM, *B. et S.*
*Hab.* Fort Colville, *Lyall.*

M. UMBRATILE, sp. nov. Dioicum, foliis laxis patentibus, inferioribus minoribus oblongis ovalibusque plus minus acutis integerrimis marginatis, superioribus elliptico-oblongis apiculo parvo terminatis, basi longe decurrentibus, marginibus breviter duplicato-serratis, nervo percurrente, cellulis omnibus rotundatis parietibus grossiusculis, perichætialibus pluribus interioribus brevioribus lanceolatis, exterioribus elongatis, caulinis angustioribus, theca in pedunculo pallide rubro horizontali oblongo cylindracea basi attenuata curvata, operculo pallido conico acuminato, cæterum *M. serrato* simillimum.
*Hab.* "Mountain Rocks, Second point of Wood, Portage River," *Drummond*; Galton Mountains, British Columbia, *Lyall.*

In appearance altogether like *M. serratum*, Brid., and with foliage, as in that species, contorted and shrinking away when dry, but in its dioicous inflorescence allied to *M. orthorhynchum*, Brid., which was mixed with Drummond's specimens of his *Bryum marginatum*, no. 259; differing, however, from this in its softer leaves with cells four times as large, and also from *M. riparium*, Mitten (*M. lycopodioides*, Bryol. Europ.), which has its cells only half as large, and the comal leaves long and narrow.

## TIMMIA, *Hedw.*

T. MEGAPOLITANA, *Hedw.*
*Hab.* Vancouver Island and Galton Mountains, British Columbia, *Lyall*; Saskatchewan, *Bourgeau.*

T. AUSTRIACA, *Hedw.*
*Hab.* Cascade Mountains and Pack River, British Columbia, *Lyall.*

### HYPNUM, *Dill.*

### (*Homalothecium et Camptothecium*, Schimp.)

H. NUTTALLII, *Wils.*

*Hab.* Vancouver Island, *Lyall*; California, *Coulter*; N.W. Coast, *Douglas.*

In its capsule completely intermediate between *H. sericeum* and *H. lutescens.*

H. LUTESCENS, *Hedw.*

*Hab.* Vancouver Island, *Lyall*: collected also by *Douglas.*

Specimens very large, and capsule rather longer than in the common European form.

H. ÆNEUM, sp. nov. Dioicum, foliis inferne ovatis sensim lanceolato-acuminatis plicatis, nervo infra apicem evanido, marginibus reflexis remote serrulatis, cellulis basi ad angulos pluribus parvis abbreviatis obscuris, superioribus elongatis angustis, perichætialibus elongatis erectis late lanceolatis apice subito subulatis serrulatis enerviis, theca in pedunculo scabro cylindracea inclinata curvata, peristomio interno processibus angustis perforatis ciliis tribus subæquilongis interpositis in membrana ad tertiam dentium longitudinis exserta, habitu omnino *H. lutescenti* simile.

*Hab.* Pend Oreille River, British Columbia, *Lyall.*

A single fertile stem with two capsules and a few stems with male flowers are all that has been seen of this moss; it resembles *H. aureum*, Lagasc., in size and general appearance, but the leaves of the stems are not so deeply plicate, and the apices lanceolate and serrulate, not attenuated into a smooth hair-like point. In the apices of the lateral branches the leaves have their points broad, somewhat acutate, and obtuse; by this particular the specimens are readily distinguished from *H. lutescens* as well.

H. NITENS, *Schreb.*

*Hab.* Saskatchewan, *Bourgeau*; Pack River, British Columbia, *Lyall.*

### (*Ptychodium et Lescurea*, Schimp.).

H. RADICOSUM, sp. nov. Dioicum, intricate cæspitosum, foliis patentibus laxe imbricatis in apicibus ramorum subsecundis ovato-lanceolatis acuminatis concavis nervo percurrente, marginibus reflexis apice serrulatis, cellulis basi pluribus abbreviatis rotundatis, superioribus oblongis mollibus, paraphyllis parvis lanceolatis, perichætialibus magnis erectis convolutis elliptico-lanceolatis acuminatis, externis enerviis, internis ad medium tenuiter nervatis apice subserrulatis.

*Hab.* Banks of the Portage River, *Drummond*, no. 225 (*H. tenax*).

So far as can be seen in the incomplete specimens, which are mixed with a fertile state of *H. uncinatum*, this species would appear to be a little larger than that found in the mountains of Switzerland and distributed by Schleicher as *Pterogonium striatum*, and since named by De Notaris *Lescurea insignis*; but in this the leaves are more concave.

The relative position of the species constituting the group known as *Lescurea*, Schimper, to *Ptychodium* ejusd. is precisely the same as that of *Pylaiesia*, Schimp., to *Hypnum cupressiforme* and of *Homalothecium* to *Camptothecium* and *Brachythecium*, the sum of the differences being only in a more erect capsule and less perfect peristome—distinctions which may serve for the arrangement of the species, but can scarcely be admitted as of generic importance when considered by the light afforded by the very natural group *Plagiothecium* and *Amblystegium*, Schimp., and also by the modifications in the peristome of *Bryum*.

All the yet described species of *Lescurea* and *Ptychodium* agree in the substance of the leaves and in the presence of paraphylla.

(*Brachythecium*, Schimp.)

H. ALBICANS, *Neck.*
*Hab.* Rocky Mountains, *Bourgeau.*

H. SALEBROSUM, *Hoffm.*
*Hab.* Saskatchewan, *Bourgeau*; Fort Colville and Pend Oreille River, *Lyall.*

H. COLLINUM, *Schleich.*
*Hab.* Cascade Mountains, British Columbia, *Lyall*; collected also in British N. America by *Drummond.*

H. ŒDIPODIUM, sp. nov. Monoicum, caule procumbente subpinnato ramis decurvis radicantibus, foliis late ovatis acuminatis, nervo medio evanido, marginibus serrulatis, cellulis oblongis elongatisque ad angulos decurrentibus pluribus quadratis, perichætialibus convolutis late ellipticis acuminatis apice serrulatis enerviis, theca in pedunculo crassiusculo sulcato minute scabro nutante ovali inæquali, operculo conico, peristomio normali ciliis duobus appendiculatis.
*Hab.* Lake Huron, *Todd*, and sent from the United States by *Cooley*; Pack River and Rocky Mountains, *Lyall.*

Stems loosly cæspitose. Leaves pale green and subcompressed, those of the ramuli more sharply serrulate; areolation soft and loose; cells generally chlorophyllose. In appearance this species has some resemblance to *H. Starkii*, and agrees with it in its thick seta and the appearance of the capsule; but the substance of the leaves is far different, and in drying they do not become striated.

H. DECLIVUM, sp. nov. Monoicum, caule procumbente subpinnato, foliis subfalcatis lanceolatis sensim acuminatis, nervo medio evanido, marginibus serrulatis, cellulis omnibus elongatis angustis, perichætialibus e basi latiore recurvis enerviis, theca in pedunculo crassiusculo scaberrimo horizontali ovali inæquali, operculo conico, peristomio normali ciliis duobus appendiculatis

*Hab.* Pend Oreille River, on *Peltigera scutata* and *P. venosa*, *Lyall.*

A small, slender species, so nearly allied to *H. velutinum*, Dill., that it might be considered merely a variety, were it not for the very much thicker and more scabrous seta and the capsule, when old, pendulous.

H. ACUTUM, sp. nov. Monoicum, caule procumbente vage subpinnato, foliis patentibus compressis ovato-lanceolatis sensim a basi ad apicem acutum angustatis siccitate longitudinaliter plicatis, nervo paulo ultra medium evanido, marginibus superne remote serrulatis, cellulis basi brevibus oblongis inde ad apicem elongatis angustis, perichætialibus e basi erecta ovali brevi nervata subulatis angustis subintegerrimis recurvis, theca in pedunculo elongato ovali inclinata inæquali, operculo conico brevi subulirostrato, peristomio normali.

*Hab.* Pack River, British Columbia, *Lyall.* Sent also from Boston by *Green.*

In size and general appearance very closely resembling some of the less robust states of *H. salebrosum*, but differing from this and nearly all the allied species in the form of its leaves gradually narrowed from just above the base to the apex and not acuminate, and in the operculum. In the compressed foliage and spreading habit not very dissimilar to some states of *H. riparium*, Dill.

H. ASPERRIMUM, sp. nov. Dioicum, caule procumbente ramis laxe subpinnatim ramosis, foliis ovatis sensim acuminatis striatis, nervo ultra medium evanido dorso denticulato, marginibus serrulatis basi anguste decurrentibus, cellulis ad angulos paucis brevioribus, superioribus elongatis angustissimis, perichætialibus e basi ovata subulato-attenuatis recurvis breviter nervatis, theca in pedunculo elongato asperrimo inclinata ovali, operculo conico acuminato, peristomio normali.

*Hab.* British Columbia, *Lyall and Douglas.*

A little more slender than the usual forms of *H. rutabulum*, Dill., and with leaves gradually narrowed to the apex, not contracted at the top of the ovate portion of the leaf, thence acuminate, the margins more strongly serrulate, and the nerve distinctly denticulate towards its apex.

(*Isothecium*, Bryol. Europ.)

H. STOLONIFERUM, *Hook. Musci Exot.* t. 74.

*Hab.* Vancouver Island, *Wood*; British Columbia, *Lyall*; N.W. America, *Menzies*; Nootka, *Barclay*.

Leaves from the primary stem, where the perichætia are produced, ovato-lanceolate, serrulate, slightly plicate, those of the ramuli elliptic-lanceolate, minutely papillose on the back above the middle, nerve smooth, continuing to three-fourths of the length of the leaves. Perichætial leaves subulate, serrulate, and recurved, from an oblong, erect, faintly two-nerved base. Seta smooth. Peristome as figured. This fine species corresponds entirely in habit with the European *H. myosuroides*, Dill.

H. SPICULIFERUM, sp. nov. Foliis infra perichætium e basi cordato-ovata lanceolato-acuminatis nervo ad $\frac{3}{4}$ evanido dorso lævibus, marginibus inferne reflexis superne serrulatis, superioribus angustioribus dorso papillosis, ramulinis elliptico-lanceolatis acutissimis concavis dorso spiculoso papillosis, nervo versus apicem denticulato, marginibus planiusculis ubique serrulatis, perichætialibus e basi erecta oblonga ultra medium uninervatis subulatis serrulatis recurvis, theca in pedunculo breviusculo lævi oblonga subæquali horizontali, operculo conico, peristomio interno processibus perforatis, ciliis singulis æquilongis, in membrana ad tertiam dentium longitudinis exserta, habitu *H. myosuroidis*.

*Hab.* British Columbia, *Lyall and Douglas*.

In habit similar to *H. myosuroides*, but the ramuli more attenuated and more curved, and the whole plant a little larger. It appears to differ from *H. stoloniferum* in its more slender habit, more abundant papillæ on its branch leaves, reflexed margin of its cauline leaves, the more strongly one-nerved perichætial leaves, and single cilium between the processes of the internal peristome.

H. ACUTICUSPIS, sp. nov. Foliis laxe imbricatis, infra perichætium late cordato-ovatis acumine angusto elongato marginibus tenuiter serrulatis apice cuspidis sublævi, nervo variante brevissimo, quasi disperso, furcato integrove medio evanido, cellulis ad angulos impressis infuscatis, ramulinis ovali-ellipticis acutis serrulatis ad medium nervatis dorso lævibus, cellulis ad angulos fuscis, perichætialibus e basi oblonga enervia subulatis recurvis subintegerrimis, theca in pedunculo breviusculo ovali inclinata, operculo conico, peristomio interno processibus perforatis ciliis duobus brevioribus interpositis, habitu *H. stoloniferi*.

*Hab.* British Columbia, *Douglas*.

Two stems only have been seen of this apparently distinct species. In size it corresponds with *H. stoloniferum*; but its leaves are much wider in proportion to their length, and loosely imbricated, so that the stems have a more terete appearance; the papillæ on the back of the leaves seem to be absent; the areolation agrees entirely with that of the preceding species, but the cells in the angles are more bossed out and coloured.

This may be *H.* (*Isothecium*) *Brewerianum*, Lesq., but its description is not sufficiently complete to be quite certain.

H. AGGREGATUM, sp. nov. Dioicum, caule primario repente, ramis erectis densissime aggregatis simplicibus parceve ramosis curvatis attenuatis, foliis inferioribus patentibus late hastato-ovatis acuminatis subenerviis sensim versus medium ramorum in late ovata, ultra medium nervata acuminata subjulacea imbricata transeuntibus, inde sensim minoribus argutiusque versus apicem serrulatis, nervo dorso apice dentiformi prominente, cellulis ad angulos pluribus minutis quadrato-rotundatis, superioribus brevibus oblongis pellucidis, perichætialibus elongatis ovato-lanceolatis seminerviis apicibus serrulatis patulis, theca in pedunculo circiter semiunciali lævi inclinata cylindracea inæquali, operculo conico acuminato, peristomio interno processibus angustis, ciliis singulis dimidio brevioribus interpositis, in membrana ad dentium tertiam longitudinis exserta.

*Hab.* Vancouver Island, *Lyall*; British Columbia, *Douglas*.

Slightly glossy, pale green tinged with brown, growing in dense patches, with the erect stems closely packed together. The leaves, from their julaceous imbrication, give the smaller plants some resemblance to some states of *Pterogonium gracile*, but they are generally much thicker and shorter. Other stems with less imbricated leaves have a resemblance to *H. myurum*, with which the habit of the plant agrees.

H. APLOCLADUM, sp. nov. Dioicum, caule procumbente apice descendente radicante ramis paucis subsimplicibus apicibus sæpe attenuatis decurvatis, foliis patentibus, in ramorum apicibus cuspidato-imbricatis, ovatis acutis nervo sub apice evanido integerrimis, in ramulis apicibus latioribus obtusioribus serrulatis, cellulis basi ad angulos pluribus quadrato-rotundatis subobscuris, superioribus oblongis parietibus teneris, perichætialibus elongatis erectis ovato-lanceolatis acuminatis apice serrulatis ultra medium nervatis, theca in pedunculo elongato sublævi erecta suberectave ovali cylindracea, operculo convexo acuminato.

*Hab.* N.W. coast of America, *Douglas*.

In appearance not unlike some specimens of *H. acuminatum*, Beauv.; but the leaves are quite smooth, and the habit would appear to be different. The seta is very slightly rough, so slightly that its roughness is only seen when specially sought for. The peristome is broken in all the capsules.

H. LENTUM, sp. nov. Dioicum, foliis patentibus laxe imbricatis, in apicibus ramorum cuspidato-imbricatis, inferioribus latioribus brevioribus in ramorum medio ubi fructus proferunt late ovatis acumine brevi, in ramulis attenuatis ovato-lanceolatis apicibus latioribus obtusioribus, marginibus tenuiter in ramulinis argutius serrulatis nervo ultra medium evanido, cellulis basi ad angulos pluribus latioribus angustioribus immixtis parietibus crassiusculis, superioribus angustis, quasi apicibus dorso prominulis, in apice oblongis, perichætialibus enerviis e basi ovali amplexante subulatis recurvis subintegerrimis, theca in pedunculo unciali scabro ovali cylindracea suberecta inæquali, peristomio interno processibus solidis ciliis singulis subæquilongis in membrana ad dentium tertiam longitudinis exserta.

*Hab.* N.W. coast of America, *Douglas.*

Of this moss only a few fragments have been seen. It appears to be about the size of the common forms of *H. myurum*, but of a loose spreading habit.

At first it was supposed that this was only a state of *H. aplocladum*; but the decidedly rough seta and wider leaves, those of the perichætium spreading, render it distinct. The scabrous seta of this moss may be considered a new feature in the group of species to which it is here referred: but after a consideration of the characters which constitute the group *Isothecium*, it becomes evident that it cannot be defined distinctly from the groups named by Schimper *Brachythecium* and *Scleropodium*; for the habit, which is the most evident characteristic of *Isothecium*, is only more conspicuous among the species forming that group than it is in *Brachythecium*, in which it is essentially the same; and the only difference between these groups is the plication of the leaves, chiefly when dry, in the group *Brachythecium*, which in *Isothecium* and *Scleropodium* is less evident, and is thus a transition to the group *Rhynchostegium*, which have the leaves more smooth.

(*Eurhynchium*, Schimp.)

H. OREGANUM, *Sullivant, in U. S. Expl. Exped.* t. 13. H. Douglasii, *Hook. MS.*

*Hab.* British Columbia, near the 49th parallel, *Lyall*; Vancouver Island, *Wood.*

Some specimens of this noble species were more than a foot long.

H. PRÆLONGUM, *Dill.* H. Stokesii, *Turn.*

*Hab.* British Columbia, near the 49th parallel, *Lyall*; Vancouver Island, *Lyall and Wood.*

This much misunderstood species has a very wide distribution, and is found in the Andes.

H. STRIGOSUM, *Hoffm.*
*Hab.* Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall*.

### PTEROGONIUM, *Sw.*

P. BRACHYPTERUM, sp. nov. Monoicum, caule procumbente inordinate pinnato ramis abbreviatis, foliis imbricatis densis late deltoideo-ovatis acuminatis (acumine angusto) concavis, margine inferne plano superne minute subserrulato, nervo concolore paulo ultra medium evanido, cellulis ad angulos minutis rotundis, reliquis brevi-ovoideis in apiculi apice elongatis, omnibus distinctis papillosis, perichætialibus erectis ovatis acuminatis nervo supra medium desinente integerrimis, cellulis elongatis areolatis teneris, theca in pedunculo elongato crassiusculo flavo ovali-cylindracea erecta æquali, operculo brevi conico, peristomio externo dentibus brevibus flavis infra os thecæ orientibus basi coalitis, interno carente, flore masculo gemmiformi majusculo.
*Hab.* British North America, *Drummond.*

Stems about one inch long. Seta half an inch high. In structure and appearance corresponding closely with the Abyssinian *P. abbreviatum*, (*Leskea*) Schimp. Quite distinct from any other North American moss.

### (*Heterocladium*, Schimp.)

P. PROCURRENS. Dioicum, caule arcuato procumbente ramis inordinatis pinnato bipinnatove, foliis caulinis divergentibus compressis cordato-ovatis sensim in acumen piliforme attenuatis marginibus tenuiter serrulatis nervis binis inæqualibus medio evanidis, cellulis in folii medio elongatis margines apicemque versus oblongis, omnibus pellucidis lævibus, rameis ovatis asymmetricis apicibus obtusiusculis, perichætialibus e basi late ovata convoluta apicibus patentibus, theca in pedunculo elongato ovali horizontali.
*Hab.* British N. America, *Drummond.*

Dull yellowish green. Stems three inches or more long, with branches varying from half to one inch in length. Seta one inch long. This species has a looser habit than the European *H. dimorphum*, Brid., and *H. Kurrii*, Sch., but agrees with them in all essential characters. It is the largest of all the species yet known.

### HYLOCOMIUM, *Schimp.*

H. TRIQUETRUM, *Linn.*
*Hab.* British Columbia, *Lyall and Douglas*; Juan de Fuca, *Seemann.*

H. LOREUM, *Dill.*
*Hab.* Vancouver Island, *Lyall and Wood*; British Columbia, *Lyall*; N.W. Coast, *Barclay*; Juan de Fuca, *Seemann.*

H. SPLENDENS, *Dill.*
*Hab.* Saskatchewan, *Bourgeau*; Vancouver Island, *Lyall and Wood*; British Columbia, *Lyall.*

*Hypnum spectabile*, Wils. MS., from Russian America, is probably *H. Ruthenicum*, Weinmann, Syll. Musc. Frond.; and his comparison of his specimens with Hedwig's figure of *Leskea filiculiformis*, Sp. Musc. t. 50, is most just and almost conclusive, for it gives a good idea of the size and appearance of the species even better than it does of the *Hypopterygium* for which it was intended.

### CLIMACIUM, *W. et M.*

C. DENDROIDES, *Linn.*
*Hab.* Pend Oreille River, British Columbia, *Lyall.*

### NECKERA, *Hedw.*

N. MENZIESII, *Hook. et Wils.*
*Hab.* Fort Colville, British Columbia, *Lyall.*

An authentic specimen in Sir W. Hooker's herbarium proves the *Mnium heteropterum* mentioned by Dr. Sibthorp in the 'Flora Græca' to be this moss,—at least so far as can be ascertained without fructification, in which in this tribe there is frequently a greater difference than in any other part of the plant.

N. DOUGLASII, *Hook.*
*Hab.* Vancouver Island, *Wood*; British Columbia, *Lyall.*

### HOMALIA, *Brid.*

H. OBTUSATA, *Mitten, Musci Ind.*
*Hab.* British Columbia, *Lyall.*

A few imperfect specimens, apparently identical with the Indian species, which differs from *H. trichomanoides*, Schreb., in its more obovate leaves more rounded at their apices, the nerve sometimes imperceptible, and the cells in the apex shorter.

### THAMNIUM, *Schimp.*

T. NECKEROIDES, (Hypnum) *Hook. Musc. Exot.* t. 58.
*Hab.* Vancouver Island, *Wood.*

One species only is enumerated by Sullivant in the United States, *T. Alleghaniense*, C. Müller; but there are the specimens of *T. neckeroides* collected by Drummond near St. Louis, no. 119; and *T. alopecurum*, (*Hypnum*) Linn., was sent from Boston by Green.

### STEREODON, *Brid.*

### (*Plagiothecium*, Schimp.)

S. PULCHELLUS, *Hedw.*
*Hab.* Fort Colville, *Lyall.*

These specimens correspond with authentic examples of *S. pulchellus* of the 'Bryologia Europæa.' But it appears very difficult to assign any constant character to *S. nitidulus*, viewed as a distinct species; for, besides these forms, there is a third, collected in Davis's Straits by Mr. Taylor, and also creeping amongst some of Drummond's specimens of *Webera longicolla*; it has its leaves about half as wide again as in *S. pulchellus*, but no other decided difference.

S. TURFACEUS, *Lindbg.*
*Hab.* Fort Colville, British Columbia, *Lyall.*

This very distinct species will doubtless in time be found in British North America.

S. GEMINUS, sp. nov. Monoicus, ramis assurgentibus intertextis, foliis ovatis ovato-acuminatisque patulis varie decurvis subsecundis subfalcatisve marginibus minute serrulatis subintegerrimisve nervis latis usque ad medium productis, cellulis angustis elongatis basi paucis brevioribus, perichætialibus erectis internis longioribus latis breviter acuminatis, theca in pedunculo elongato ovali-cylindracea suberecta collo sensim attenuato, peristomio interno processibus angustis ciliis binis subæquilongis interpositis.
*Hab.* Rocky Mountains, alt. 6000–8000 feet, associated with *S. pulchellus* and *Mnium umbratile*, Mitten, *Lyall.*

Somewhat similar to *S. pulchellus*, Hedw., but with leaves more gradually narrowed from a wider base, the thin but wide nerves continued to about the middle, the margin more or less evidently serrulate from the base to the apex, and the cells only half as long and narrower.

S. DONIANUS, *Sm.*
*Hab.* Fort Colville, *Lyall.*

S. UNDULATUS, *Hedw.*
*Hab.* Fort Colville, *Lyall.*

### (*Orthothecium*, Schimp.)

S. CHRYSEUS, (Hypnum chryseon) *Hornsch.*
*Hab.* Rocky Mountains, *Bourgeau and Drummond*, no. 221.

This species has been brought from Beechey Island, Wellington Channel, and Pond's Bay, in Arctic America, by Dr. Lyall, but, excepting Drummond's specimens, all are without fruit.

*S. rufescens*, Dicks., in a small state, was collected in Davis's Straits by Mr. Taylor; and from the same region he brought another species, which will certainly be found in Europe when carefully sought for. It may be characterized thus:—

S. RUBELLUS, sp. nov. Dioicus, cæspitosus, ramis erectis parce ramosis, foliis imbricatis ovatis concavis apiculo brevi flexuoso marginibus revolutis nervis binis brevissimis, cellulis elongatis alaribus inconspicuis, perichætialibus imbricatis ovato-lanceolatis.

*Hab.* Davis's Straits, *Taylor*; Rocky Mountains, *Drummond*, intermixed with *Catoscopium nigritum*, Hedw. Sassar Pass, Nubra Mountains, Tibet, alt. 16,000–17,000 feet, *Thomson*.

A small moss, with all the habit, appearance, and colour of *Orthothecium intricatum*, Bryol. Europ., but differing in its almost exactly ovate leaves, with a short, sometimes discoloured apiculus, the margins revolute, and the areolation composed of cells which are twice as wide. In the same particulars it differs from *O. rufescens* and *O. chryseum*.

(*Pylaiesia*, Schimp.)

S. POLYANTHUS, *Schrad.*

*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau*.

This moss appears to be abundant in British America.

(*Drepanium*, Schimp.)

S. REPTILIS, *Mich.*

*Hab.* Kootenay River, British Columbia, *Lyall*.

S. PLICATILIS, sp. nov. Dioicus, fastigiate ramosus, foliis falcatis secundis late ovatis acuminatis hamatis siccitate ruguloso-subplicatis, nervis brevibus, marginibus reflexis integerrimis, in ramulinis apice serrulatis, cellulis ad angulos pluribus abbreviatis parvis obscuriusculis, superioribus latitudine $\frac{1}{6000}$ longitudine $\frac{5-8}{6000}$ circiter unciæ metientibus parietibus tenuibus, perichætialibus erectis elongatis internis late oblongo-lanceolatis apice subulatis integerrimis plicatis, theca in pedunculo elongato cylindracea basi erecta medio curvata, operculo conico, peristomio interno processibus luteis perforatis ciliis binis æquilongis nodulosis interpositis.

*Hab.* Davis's Straits, *Taylor*; Rocky Mountains, *Bourgeau*. Also the "*Hypnum cupressiforme β. compressum*," Sweden, *Sommerfeldt*, in Herb. Hooker, appears to be the male plant, but is much less than any of the American specimens.

In size and general appearance the few specimens yet seen of this moss resemble *Hypnum callichroum*, Brid., and are pale yellowish green, the older parts brown; it differs from all the states of *H. cupressiforme* in the strongly reflexed margins of its leaves and short cells.

S. CIRCINALIS, *Hook. Musc. Exot.* t. 107.
*Hab.* Vancouver Island, *Lyall.*

S. PLUMIFER, sp. nov. Dioicus, cæspitosus, ramis procumbentibus, ramulis approximatis plumiformi-pinnatis, foliis falcatis secundis e basi latiore subovato-lanceolatis sensim tenuiter angustatis hamatis siccitate subplicatis, nervis tenuibus brevibus, marginibus inferne reflexis integerrimis, in ramulinis apice serrulatis, cellulis ad angulos paucis abbreviatis subobscuris, superioribus elongatis angustis, perichætialibus elongatis erectis pallidis late lanceolato-subulatis apicibus serrulatis, theca in pedunculo elongato longe cylindracea suberecta curvata, operculo brevi subulato rostrato, peristomio dentibus pallidis teneris, interno tenero processibus latiusculis perforatis ciliis binis æquilongis angustis interpositis in membrana alte exserta.
*Hab.* N. America, *Drummond*; Canada, *Shepherd*; Columbia, *Douglas*; N.W. coast of America, *Douglas and Menzies*; Pack River, *Lyall.* Very common on trees and on the ground in British Columbia, *Lyall*; Vancouver Island, *Lyall.*

Shining yellowish green, becoming in age pale brown, more slender than *H. imponens*, and in habit approaching more to *H. crista castrensis*. In its narrow glossy leaves, long curved capsule, and rostrate operculum it is sufficiently distinct from *H. imponens* and *H. hamulosum*. This may be the *H. subimponens*, Lesq.; but the operculum is different from that described in the short account of the species.

S. CRISTA CASTRENSIS, *Linn.*
*Hab.* Saskatchewan, *Bourgeau.*

S. ROBUSTUS, *Hook. Musc. Exot.* t. 108.
*Hab.* Fort Colville and Pack River, *Lyall.*

Very few specimens, which give no further information as to the habit of the species.

Belonging to this group are also—

S. COMPLEXUS, sp. nov. Dioicus, late cæspitosus, ramis pinnatis, foliis secundis e basi latiore ovato-lanceolatis hamatis concavis nervis binis brevibus marginibus subintegerrimis, cellulis ad angulos pluribus abbreviatis subquadratis obscurioribus, superioribus elongatis angustis apicibus quasi prominulis, perichætialibus elongatis erectis oblongis subulatis, internis lanceolatis subito subulatis subserrulatis plicatis, theca in pedunculo rubro cylindracea inæquali inclinata, peristomio dentibus flavis e medio subulatis, interno processibus angustis ciliis binis interpositis.
*Hab.* On rocks between Fort William and Cumberland House, British N. America, *Richardson.*

In large interwoven patches of a dull-green colour. In general appearance very similar to that form of *H. cupressiforme* known as "*tectorum*," but its affinity is in other respects with *H. reptile*, Mich., in the form and especially the substance of its leaves, and in the plication of those of the perichætium; but the present species is certainly dioicous, more robust, and with scarcely serrulate leaves.

S. CIRCULARIS, sp. nov. Caule rufescente fastigiate ramoso, foliis secundis circinatis ovato-lanceolatis apice angustis acutis, breviter binervatis marginibus basi tantum subserrulatis, cellulis ad angulos paucis abbreviatis subobscuris flavidis, superioribus elongatis latitudine $\frac{1}{6000}$ longitudine $\frac{10-12}{6000}$ circiter unciæ metientibus pellucidis.
*Hab.* Beechey Island and Wellington Channel, *Lyall.*

Pale yellowish green slightly tinged with brown. Stems one or two inches high; branches irregularly disposed, fastigiate; leaves all circinate, and so closely directed to the ventral side of the stem as to be laterally compressed. In general appearance and size nearest to *H. callichroum*, Brid., but the areolation of the base of the leaf is different.

### (*Limnobium*, Schimp.)

S. OBTUSIFOLIUS, *Hook. et Wils.*
*Hab.* Poseidon River, *Lyall.*

A few specimens, all without fruit.

S. ARCTICUS, *Sommerf.*
*Hab.* Rocky Mountains, *Lyall.*

S. OCHRACEUS, *Turner.*
*Hab.* Cascade Mountains, British Columbia, *Lyall.* This moss is found also in Davis's Straits; and a few fragments of *S. turgescens*, Schimper, were also obtained there by Mr. Taylor.

### (*Cuspidaria*, C. Müller.)

S. SCHREBERI, *Willd.*
*Hab.* Saskatchewan, *Bourgeau.*

This species does not well range here.

S. CUSPIDATUS, *Linn.*
*Hab.* Pack River, *Lyall.*

S. RICHARDSONI, sp. nov. Monoicus, cæspitosus, ramis inordinatim pinnatis apice cuspidatis, foliis patentibus late ovatis apice rotundatis obtusis concavis integerrimis nervo medio evanido, ramulinis oblongo-lanceolatis obtusis, cellulis elongatis apicibus prominulis alaribus laxis ventricosis pallidis, perichætialibus ovalibus acutis lævibus imbricatis seminerviis, theca in pedunculo elongato rubro cylindracea arcuata horizontali, peristomio normali.

*Hab.* N. America, *Richardson*. Supposed by Drummond to be from the Great Bear Lake. Coast of Greenland, Baffin's Bay, *Inglefield*.

The general appearance and yellowish-brown colour of this species is closely similar to that of *H. cuspidatum*, and it is intermediate between it and *H. cordifolium*.

S. GIGANTEUS, *Schimp.*

*Hab.* Fort Colville, *Lyall*.

This is the species distributed as *H. cordifolium* by Drummond, no. 209, but all the American examples are more slender than European specimens.

(*Campylium*, Schimp.)

S. CHRYSOPHYLLUS, *Brid.*

*Hab.* Saskatchewan, *Bourgeau*.

S. HISPIDULUS, *Brid.*

*Hab.* Mooyie River, *Lyall*.

(*Amblystegium*, Schimp.)

S. COMPACTUS, *Bruch et Schimp.*

*Hab.* Near Fort Colville, *Lyall*.

S. RADICALIS, *Beauv.*!

*Hab.* Saskatchewan, by the river near Fort Ellice, *Bourgeau*; Pack River, Galton Mountains, and Cascade Mountains, *Lyall*.

This much misunderstood species differs from *S. serpens*, Linn., in its narrower and longer leaf-cells; it occurs in Europe, but is confused with the following species.

S. VARIUS, (Leskea) *Hedw.*

*Hab.* Saskatchewan, *Bourgeau*; Pend Oreille River, *Lyall*.

S. RIPARIUS, *Linn.*

*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau*.

S. KNEIFII, *B. et S.*

*Hab.* Rocky Mountains, *Lyall*; Saskatchewan, *Bourgeau*.

S. UNCINATUS, *Hedw.*

*Hab.* Cascade, Galton, and Rocky Mountains, *Lyall*.

S. VERNICOSUS, *Lindbg.*

*Hab.* Pack River, *Lyall*.

S. FILICINUS, *Linn.*

*Hab.* Saskatchewan, *Bourgeau*; Mooyie River, *Lyall*. The variety *Vallis-Clausæ* in running water, Fort Colville, *Lyall*.

S. COMMUTATUS, *Hedw.*

*Hab.* Rocky Mountains, *Bourgeau*.

## FONTINALACEÆ, *Schimp.*

### DICHELYMA, *Myrin.*

D. UNCINATUM, sp. nov. Foliis tristichis falcatis secundis lanceolatis sensim longe tenuiter angustatis complicatis nervo excurrente apice denticulato marginibus e medio ad apicem minute serrulatis, cellulis elongatis angustis, perichætialibus convolutis externis oblongis obtusis internis elongatis acutioribus, theca in pedunculo brevi exserta ovali interdum inæquali, operculo subulato subæquilongo, peristomio interno toto cancellato externo paulo longiore, habitu *D. falcati.*

*Hab.* Fort Colville, British Columbia, *Lyall.*

Rather more slender than *D. falcatum*, Myrin, and its stems more subpinnate; its leaves more setaceous from the excurrent nerve, which is smooth beyond the serrulate margins and denticulate only at its apex. The perichætial leaves are not twisted; and the internal peristome, which resembles a perfect cancellate cone, only exceeds the external teeth by about one-fifth of their length.

Male plants of *D. falcatum* have sometimes leaves with narrow points, but it is difficult to see if the nerve is continued into them, or if they are merely a prolongation beyond it, as is common in many mosses. The calyptra is not adherent by its base in any of the specimens of *D. uncinatum.*

### FONTINALIS, *Dill.*

F. ANTIPYRETICA, *Linn.*

*Hab.* On stones in the river, Fort Colville, British Columbia, *Lyall.*

Appears to be identical with the European species.

F. SQUAMOSA, *Linn.*

*Hab.* Saskatchewan, *Bourgeau.*

### LESKEA, *Hedw.*

#### (*Leskea.*)

L. POLYCARPA, *Ehrh.*

*Hab.* British Columbia, Pend Oreille River, *Lyall.*

#### (*Thuidium*, Schimp.)

L. GRACILIS, *B. et S.*

*Hab.* Saskatchewan, *Bourgeau.*

This is probably *Hypnum* (*Stereodon*) *Virginianum*, Brid.

L. ABIETINA (*Linn.*).

*Hab.* Lake Winnipeg, *Bourgeau.*

L. BLANDOVII (*Web. et Mohr*).

*Hab.* Fort Colville, *Lyall.*

L. DELICATULA (*Linn.*).
*Hab.* Saskatchewan, *Bourgeau.*

L. CRISPIFOLIA, *Hook. Musci Exot.* t. 31.
*Hab.* British Columbia and Pend Oreille River, *Lyall*; Vancouver Island, *Wood.*

### TRACHYPUS, *Schw.*

T. NIGRESCENS, (Neckera) *Sw.*
*Hab.* Lake Huron, in fruit, *Todd*; also sent from Canada West, *Emery*, in Herb. Miles.

The occurrence of this species (which seems to be precisely the same as Swartz's, from a specimen in Herb. Hooker.) in a country so much further north, was at first regarded with some suspicion, but this is now entirely removed by the specimens recently collected by Mr. Emery.

## LEUCODONTACEÆ, *Mitten, Musci Ind.*

### HEDWIGIA, *Ehrh.*

H. CILIATA, *Ehrh.*
*Hab.* Mooyie River (a branch of the Kootenay), British Columbia, *Lyall.*

HEDWIGIA PILIFERA, sp. nov. Monoica, ramis ascendentibus laxe cæspitosis dichotome divisis ramulis superioribus abbreviatis, foliis subsecundis ovatis ovato-acuminatisque acumine diaphano, foliis ramulinis (flagelliformibus) pilo longo flexuoso terminatis marginibus integerrimis revolutis, cellulis parvis breviter oblongis inferioribus paululo longioribus basi fuscis dorso papillosis, perichætialibus erectis longioribus ovato-lanceolatis, theca in pedunculo gracillimo trilineari subglobosa ætate evacua sub ore amplo contracta circiter decemplicata, calyptra elongata cucullata fusca lævi.
*Hab.* Vancouver Island, on rocks, *Lyall.*

A little more slender than *H. ciliata*, Ehrh., but agreeing very nearly with it in general appearance. The younger portions of the stems are of a yellowish green, the older brown. The fruitstalk is very slender and pale red. The capsules, which are all old and empty, are contracted below the mouth, and the fruitstalk is affixed to their base without an attenuated neck.

This species has been here referred to *Hedwigia*, although it belongs to that small group of species which has been named by M. Schimper *Hedwigidium*, differing from *Hedwigia*, as originally founded by Ehrhart on *H. ciliata*, in the more cucullate calyptra and the presence of flagelliform shoots; these last are represented in *H. pilifera* by short ramuli, with leaves having very long hair points, but in all the specimens these ramuli are not decurved, nor would they be distinguishable from the others except by their leaves. The capsule of *H. pilifera* and *H. imberbis* is plicate when old, but this character is observable in *H. Humboldtii*, Hook., which is considered by M. Schimper to present distinctions sufficient to constitute another genus, *Harrisonia*, and, according to him, to be placed amongst the pleurocarpous mosses; but there is no real difference in the position of the fertile flower in any of the species; and the distinctions upon which these genera have been propounded, when considered in connexion with those existing between the species of eminently natural genera, such as *Orthotrichum* and *Fissidens*, seem to be merely specific. The original position of the fertile flower appears to be terminal on the branches, which, producing innovations from immediately below it, render it apparently lateral in the more branched species.

Among the species included in the genera *Hedwigia*, *Hedwigidium*, *Braunia*, and *Harrisonia*, there is the closest affinity in the structure of the leaves and in the mode of growth, excepting that *H. ciliata* is destitute of flagelliform branches. In the form of the capsule there is considerable diversity; in *Hedwigidium* and *Harrisonia* it is short and plicate, in *Braunia* it is elongate and smooth. In all these genera the calyptra is elongate and cucullate, in *Hedwigia* it is short and mitriform; but the value of the genera distinguished by these characters is destroyed when compared with other groups of species forming the most natural genera, *Orthotrichum* and *Grimmia*. In the first there is as great a diversity in the form and plication of the capsule, and in the second as much difference in the calyptra of species in most other respects so very closely resembling each other, that more confusion would arise in dividing them on the strength of that character alone than in leaving them together. The distinctions therefore between the *Hedwigiæ*, measured in comparison, are rather of a sectional and specific nature than generic, and the mere multiplication of genera serves no useful purpose.

The position of the species composing the group here understood as *Hedwigia* has been variously estimated by authors. Müller places them amongst his Hypnoid mosses, *H. ciliata* in his *Pilotrichum*, and the residue in the section *Pterygynandrum* of his interpretation of the genus *Neckera*. Schimper places them, excepting *H. Humboldtii*, between his families *Grimmiæ* and *Ptychomitriæ*; but the affinity between some forms of *Grimmia* and *Hedwigia ciliata* is less than that existing between the flagelliferous *Hedwigiæ* and *Leucodon sciuroides*, which produces flagella of exactly the same kind as those of *H.* (*Braunia*) *sciuroides*. In *Cryphea* there are several species which closely resemble *H. ciliata* and *H. imberbis*, having their fruit terminal on their branches, and immersed in a similar manner. There is also a great resemblance between the more branched *Hedwigiæ* and *Antitrichia curtipendula*, Brid., which also produces the same kind of flagella, and is in reality itself only a *Leucodon* with a more completely developed peristome, and improperly separated from that genus.

Since the foregoing description of this moss was written, there has appeared, in the Transactions of the American Philosophical Society, Mr. Lesquereux's description of *Braunia Californica*, which, in so far as can be generally gathered from the description, would appear to indicate the same species. On consideration, however, as there are some discrepancies, it has been thought best to let the description of *H. pilifera* stand, and to point out the differences which exist between Dr. Lyall's specimens and Mr. Lesquereux's description. They are, in our specimens, the stems not "vel simplicibus vel irregulariter innovando ramosis," nor "apice incrassatis duris;" the perichætial leaves not "brevioribus," but elongated, and the capsule plicate—in fact it is just the capsule of *H. imberbis* on an elongated pedicel. Mr. Lesquereux says that his species has a capsule "exactly top-shaped" when deoperculate, but nothing about the plication so evident in our specimens.

### ANTITRICHIA, *Brid.*

A. CURTIPENDULA, *Linn.*

*Hab.* Vancouver Island, *Wood*; British Columbia, *Lyall and Douglas.*

Very different in external appearance from the usual European states; but there seems to be no sufficient distinction between these specimens and the form which has a more slender habit and elongate capsules, enumerated by Schimper as var. β. *Hispanica.* Some of the specimens are very slender.

### SPIRIDENS, *Nees.*

S. ABIETINUS, *Hook. Musc. Exot.* t. 7.

*Hab.* British Columbia, *Lyall, Douglas, and Menzies.*

## POLYTRICHACEÆ.

### BUXBAUMIA, *Haller.*

B. APHYLLA, *Haller.*

*Hab.* Cascade Mountains, British Columbia, *Lyall.*

### ATRICHUM, *Beauv.*

A. UNDULATUM (*Linn.*).
*Hab.* Fort Colville, *Lyall.*

A. PARALLELUM, sp. nov. Dioicum ?, caulibus breviusculis, in fertilibus foliis superioribus ligulato-lanceolatis, basi pro spatio oblongo inferne cellulis oblongis superne rotundatis areolato subintegerrimo lævibus, inde marginibus argute dentatis, dorso laminis dentiformibus nervo lamellato percurrente parallelis, nervo etiam dorso lamellis circiter tribus serratis carinato, foliis inferioribus oblongis obtusioribus, perichætialibus e basi oblonga convoluta sensim angustatis lanceolatis, theca in pedunculo elongato cylindracea curvata basin versus ventricosa.
*Hab.* Grande Côte, Rocky Mountains, *Drummond,* intermixed with *Oligotrichum aligerum.*

Size and habit of *A. undulatum,* Linn., but capsules more ventricose below. Intermixed with the fertile stems are others of about the same height, having the leaves all short and with a terminal bud, which appears to be young male inflorescence, but too young to be safely considered such. The parallel disposition of the tooth-like processes on the back of the leaf and the cristate nerve suffice to distinguish this species from *A. undulatum,* for which it was overlooked by Drummond.

### OLIGOTRICHUM, *DeCand.*

O. ALIGERUM, sp. nov. Caule breviusculo, foliis patulis e basi brevi paululo latiore oblonga lævi integerrima cellulis quadrato-rotundatis distinctis viridibus areolata lanceolatis obtusiusculis brevi-dentatis dorso lamellis dentatis longitudinalibus alatis, nervo percurrente lamellato dorso etiam lamellis circiter quinis dentatis carinato, perichætialibus caulinisque perichætium versus e basi obovata vaginante erecta cellulis elongatis pellucidis areolata subulatis angustioribus cæterum caulinis similibus, theca in pedunculo elongato cylindracea inferne ventricosa curvata, calyptra apice pilis paucis hirta.
*Hab.* Grande Côte, Rocky Mountains, *Drummond.*

In size and general appearance like *O. hercynicum,* for which species it was overlooked by Drummond himself; but its leaves are narrower, and when dry more crisped, and the presence of the lamellæ on the underside of the leaf itself, as well as upon both sides of the nerve, is remarkable and peculiar.

### POGONATUM, *Brid.*

P. ALPINUM (*Dill.*).
*Hab.* Between Fort Colville and Cascade Mountains, British Columbia, *Lyall.*

Some of the specimens from N.W. America are very large, with the leaves spreading and recurved, and the capsule erect and elongate, but there appears to be no real difference excepting the external appearance.

Besides the *P. contortum*, Menzies, collected by himself in N.W. America, there are in Herb. Hooker. some specimens, not in a very good state, of what appears to be another species, more nearly allied to *P. aloides*.

P. ATROVIRENS, sp. nov. Caule simplici elongato, foliis patentibus siccitate incurvis subcrispatis e basi latiore cauli appressa late lanceolatis acutis marginibus fere a basi ad apicem serratis nervo dorso dentato pagina superiore partis folii lanceolatis lamellis fere tota obtecta, theca in pedunculo unciali oblonga erecta, operculo convexo brevirostro.

*Hab.* Sitka, *Barclay*.

About three inches high, blackish brown. Foliage softer than in *P. aloides*, the base with larger cells, the margins serrate almost to the very base.

*P. contortum* differs from this in its leaves being more nearly lanceolate throughout, not sheathing below, and the areolation at the base nearly the same as on the upper part, where they are more gradually narrowed into the point.

## POLYTRICHADELPHUS, *C. Müller*.

P. LYALLII, sp. nov. Caule brevi breviter fastigiatim ramoso inferne subnudo superne, foliis e basi oblonga latiore erectiore amplexante lanceolatis patentibus sensim acutis lamellis obtectis marginibus e medio ad apicem serratis incurvis dorso convexis lævibus aut in superioribus paucidentatis, perichætialibus internis basi longioribus convolutis apicibus bevioribus, theca in pedunculo elongato flexuoso rubro suboblonga inferne ventricosa inclinata ætate horizontali supra biplicata spatio intermedio concava infra irregulari convexa basi apophyse plicata rugosa brevi sub ore contracto, operculo subuli-curvirostrato, calyptra pilis paucis brevibus appressis.

*Hab.* In swampy places on the east side of the Cascade Mountains, British Columbia, at an elevation of 7000 feet, July 1860, *Lyall*.

All the specimens agree in their short stems, rarely simple, with a single perichætium, but branched in a close fastigiate manner, so that at first sight the stems have the appearance of bearing a number of setæ from nearly the same point; on examination, however, each seta is found to be terminal on its own proper branch, and of these as many as nine have been observed on the same stem; the habit is thus the same as in *P. dendroides*, with the stems and branches abbreviated and the setæ lengthened.

### POLYTRICHUM, *Dill.*

P. PILIFERUM, *Schreb.*
*Hab.* Vancouver Island, *Lyall.*

P. JUNIPERINUM, *Hedw.*
*Hab.* Saskatchewan, *Bourgeau.* Vancouver Island and near Fort Colville, British Columbia, *Lyall.* The variety *alpestre* on Cascade Mountains, British Columbia, *Lyall.*

### SPHAGNUM, *Dill.*

S. ACUTIFOLIUM, *Ehrh.*
*Hab.* Saskatchewan and Lake Winnipeg, *Bourgeau.*

## HEPATICÆ.

A small number of species belonging to this order, without any new form, are present in the collections from the Survey; and the species which in Europe are found on the ground are almost entirely unrepresented in the collections yet seen from British North America.

### JUNGERMANNIA, *Linn.* (*Syn. Hepat.*).

J. BARBATA, *Schreb.*
*Hab.* The var. *lycopodiodes*, Nees, Galton Mountains, and on stones in the Columbia River, *Lyall.* The var. *quinquedentata*, Nees, Galton Mountains, *Lyall.* The var. *Floerkii*, Nees, Kettle Falls, Columbia River, *Lyall.*

J. VENTRICOSA, *Dicks.*
*Hab.* Vancouver Island and Fort Colville, *Lyall.*

J. INCISA, *Schrad.* J. supina, *Taylor.*
*Hab.* Fort Colville, *Lyall.*

J. MICHAUXII, *Weber.* J. oblongata *et* J. anacampta, *Taylor.*
*Hab.* Near Fort Colville and Columbia River, *Lyall.*

J. EXSECTA, *Schmid.* J. scitula, *Taylor.*
*Hab.* Fort Colville, *Lyall.*

J. CORDIFOLIA, *Hook.*
*Hab.* Fort Colville and Galton Mountains, *Lyall.*

J. RIPARIA, *Taylor.*
*Hab.* On stones in the Colville River, Fort Colville, *Lyall.*

J. SCHRADERI, *Mart.*
*Hab.* About Fort Colville and the Colville River, *Lyall.*

### LIOCHLÆNA, *Nees.*

L. LANCEOLATA, *Nees*,
*Hab.* Mooyie River, British Columbia, *Lyall.*

### SOLENOSTOMA, gen. nov.

*Perianthium* terminale, obovatum, superne quinqueplicatum, ore in tubulum brevem contracto rostelliformi. *Folia* disticha, integra. *Amphigastria* parva obsoletave.

S. TERSUM, (Jungermannia) *Nees.*
*Hab.* Galton Mountains, *Lyall.*

Two species only of this group are yet certainly known from the whole of N. America. The other species, *S. crenulatum* (*Jungermannia*, Sm.), is indicated by Sullivant in Alabama.

This genus, long confounded with *Jungermannia*, differs from it in the form and plication of the perianth, which is similar to that of *Lejeunia* and *Frullania*, and only becomes dentate at the apex by the bursting through of the capsule.

### LEIOSCYPHUS, *Mitten.*

L. TAYLORI, *Hook.*
*Hab.* Cascade Mountains, *Lyall.*

### PLAGIOCHILA, *Nees et Mont.*

P. ASPLENIOIDES (*Linn.*).
*Hab.* Fort Colville, *Lyall.*

### LOPHOCOLEA, *Nees.*

L. HETEROPHYLLA, *Hook.*
*Hab.* Fort Colville, *Lyall.*

The few fragments supposed to belong to this species are merely sufficient to indicate the presence of something very nearly allied, if not identical.

### TRIGONANTHUS, *Spruce, in Trans. Bot. Soc. Edin.* vol. iii. *et in Ann. & Mag. Nat. Hist.* s. 2. vol. v. p. 207.

(*Jungermanniæ bicuspides*, Synops. Hepat.)

T. BICUSPIDATUS, *Linn.*
*Hab.* Rocky Mountains, *Lyall.*

T. DIVARICATUS, *Smith, Eng. Bot.* t. 719. Jungermannia Starkii, *Fk. Synops. Hepat.* p. 134.
*Hab.* Cascade Mountains, British Columbia, *Lyall.*

These specimens have stipules, as is usual in the form referred to *J. Starkii.*

T. DENTATUS, *Raddi.*
*Hab.* Galton Mountains, British Columbia, *Lyall.*

## CHILOSCYPHUS, *Corda.*

C. POLYANTHUS (*Linn.*).
*Hab.* Near Fort Colville, *Lyall.*

## HARPANTHUS, *Nees.*

H. FLOTOVIANUS, *Nees.* Pleuranthe olivacea, *Taylor, in Lond. Journ. Bot.* 1846, p. 282; *Synops. Hepat.* p. 689.
*Hab.* Rocky Mountains, *Bourgeau.*

*Chiloscyphus Drummondii,* Taylor (Lond. Journ. Bot. 1846, p. 283; Synops. Hepat. p. 709), appears to be in no way different from *H. scutatus,* (*Jungermannia*) Weber et Mohr; and the habitat of this and some other North American species was incorrectly given by Taylor "in arborum cortice," for the plants are found growing on rotten wood.

## SCAPANIA, *Lindenberg.*

S. ALBICANS (*Linn.*).
*Hab.* Rocky Mountains, *Bourgeau.* Fort Colville, *Lyall.*

S. NEMOROSA (*Linn.*).
*Hab.* British Columbia, *Lyall.*

S. UNDULATA (*Linn.*).
*Hab.* Rocky Mountains, *Lyall.*

## LEPIDOZIA, *Nees.*

L. REPTANS, *Linn.*
*Hab.* Fort Colville, *Lyall.*

## MASTIGOBRYUM, *Nees.*

M. AMBIGUUM, *Lindenberg.*
*Hab.* British Columbia, *Lyall.*

## RADULA, *Nees.*

R. COMPLANATA, *Linn.*
*Hab.* British Columbia, *Lyall.*
A few fragments only.

## MADOTHECA, *Dumort.*

M. NAVICULARIS, *Nees.* M. Douglasii, *Tayl. Lond. Journ. Bot.* 1846, p. 379.
*Hab.* Vancouver Island and near Fort Colville, British Columbia, *Lyall.*

M. LÆVIGATA, *Schrad.*
*Hab.* Kettle Falls, Columbia River, *Lyall.*

M. PLATYPHYLLOIDEA, *Nees.*
*Hab.* Fort Colville, *Lyall.*

### PTILIDIUM, *Nees.*

P. CILIARE, *Ehrh.*
*Hab.* Fort Colville, *Lyall.*

### CHÆTOPSIS, gen. nov.

*Perianthium* terminale, obovatum, tubulosum, ore connivente ciliato. *Folia* et *amphigastria* palmatifida.

C. TRICHOPHYLLA, *Linn.*
*Hab.* Cascade Mountains, *Lyall.*

### FRULLANIA, *Raddi.*

F. TAMARISCI, *Linn.*
*Hab.* Vancouver and Orcas Islands, *Lyall.* Collected also on the N.W. coast by *Menzies and Douglas.*

The specimens are very slender, and at first sight would scarcely be supposed to belong to the same species as the European forms. The leaves are rounded, in the fertile stems acute, in the male plants with the point inflexed, and the coloured cells in some of the leaves are only found after careful search. No American examples have yet been seen which can compare with British ones in size.

### METZGERIA, *Raddi.*

M. PUBESCENS, *Schrank.*
*Hab.* British Columbia, *Lyall.*

### SARCOMITRIUM, *Corda.*

S. PALMATUM, *Hedw.*
*Hab.* Fort Colville, *Lyall.*

### MARCHANTIA, *Linn.*

M. POLYMORPHA, *Linn.*
*Hab.* Saskatchewan and Rocky Mountains, *Bourgeau.* Fort Colville and Sinyakwateen, *Lyall.*

### FEGATELLA, *Raddi.*

F. CONICA, *Linn.*
*Hab.* British Columbia, near Fort Colville, *Lyall.*

## EXPLANATION OF THE PLATES.

### PLATE V.

*Barbula rubiginosa.*

1, plant, natural size.

2, leaf; 3, transverse section of same; 4, perichætial leaf; 5, capsule: all magnified.

*Encalypta longipes.*

1, plant, natural size.

2, leaf; 3, perichætium; 4, capsule: all magnified.

*Hypnum æneum.*

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætial leaf; 5, capsule; 6, portion of peristome: all magnified.

*Hypnum œdipodium.*

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

### PLATE VI.

*Hypnum declivum.*

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

*Hypnum acutum.*

1, plant, natural size.

2, cauline leaf; 3, perichætial leaf and male flower; 4, capsule; 5, portion of peristome: all magnified.

*Hypnum asperrimum.*

1, plant, natural size.

2, cauline leaves; 3, branch leaf; 4, perichætium; 5, capsule; 6, portion of peristome: all magnified.

*Hypnum aggregatum.*

1, plant, natural size.

2, stem leaves; 3, perichætium; 4, capsule; 5, portion of peristome: all magnified.

### PLATE VII.

*Pterogonium procurrens.*

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, porichætium; 5, capsule: all magnified.

*Stereodon plumifer.*

1, plant, natural size.

2, stem leaves, with transverse section; 3, branch leaf; 4, perichætium; 5, capsule; 6, portion of peristome: all magnified.

*Stereodon geminus.*

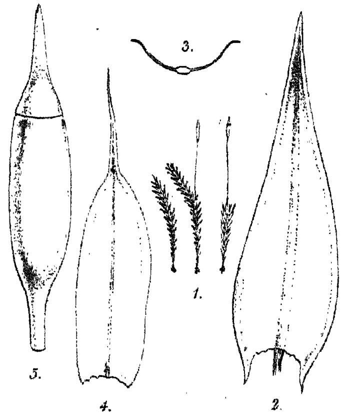
1, plant, natural size.

2, stem leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

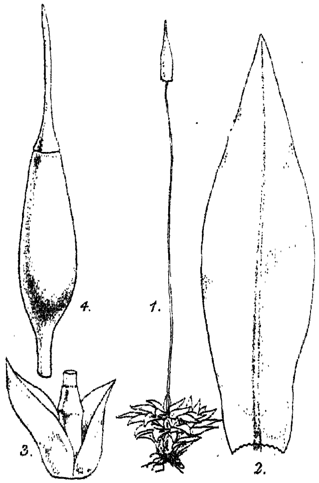
*Hedwigia pilifera.*

1, plant, natural size.

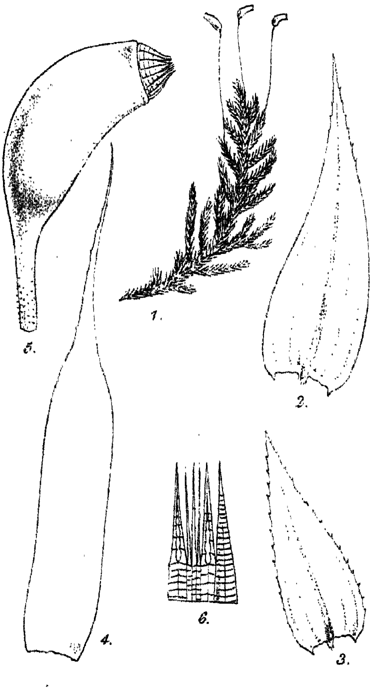
2, stem leaf; 3, leaves from the branches; 4, transverse section; 5, perichætium; 6, male flower; 7, capsule: all magnified.



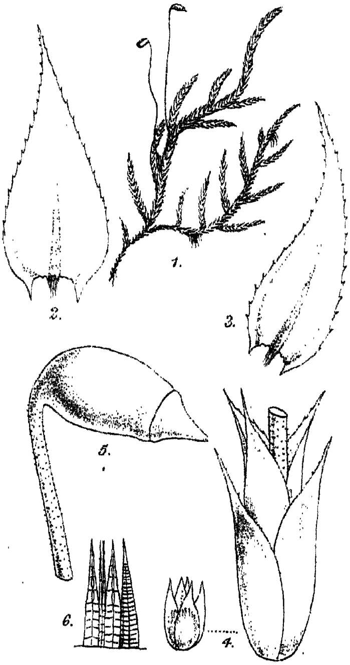
Barbula rubiginosa.



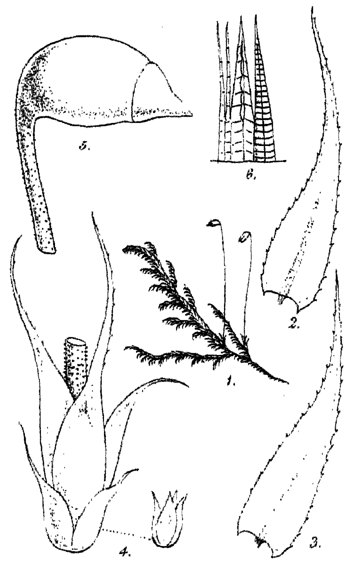
Encalypta longipes



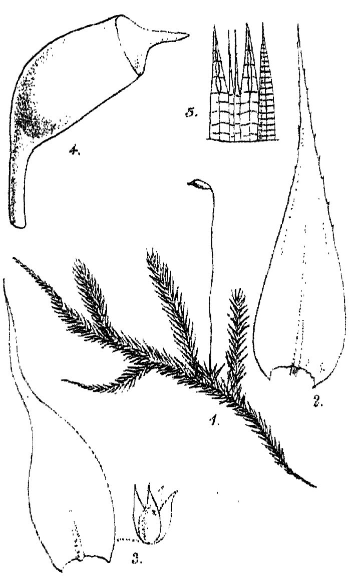
Hypnum æneum.



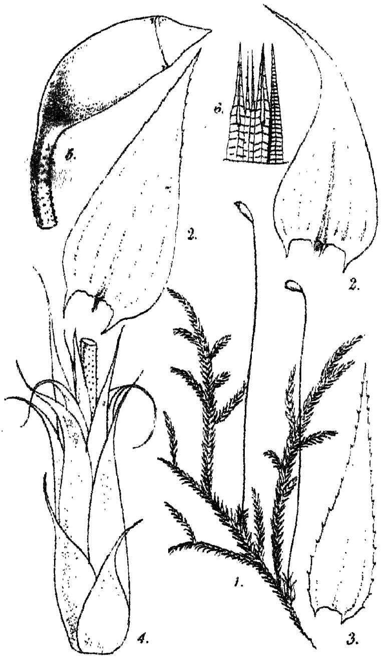
Hypnum œdipodium



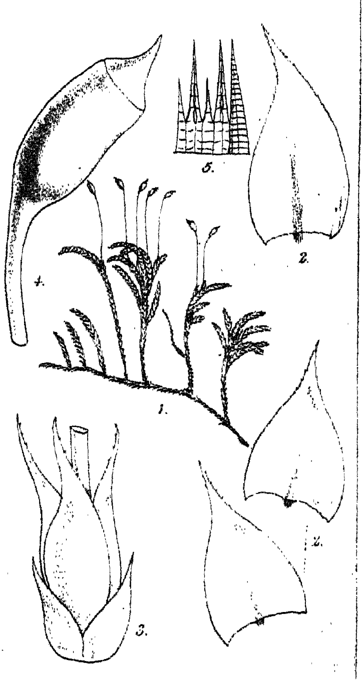
Hypnum declivum.



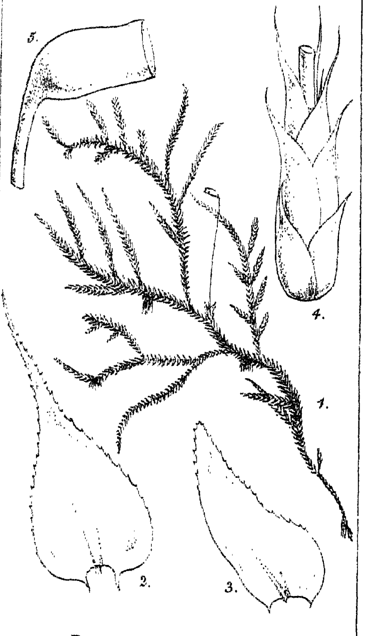
H. acutum.



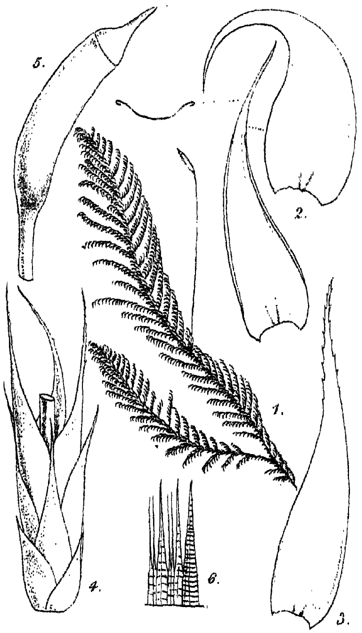
H. asperrimum.



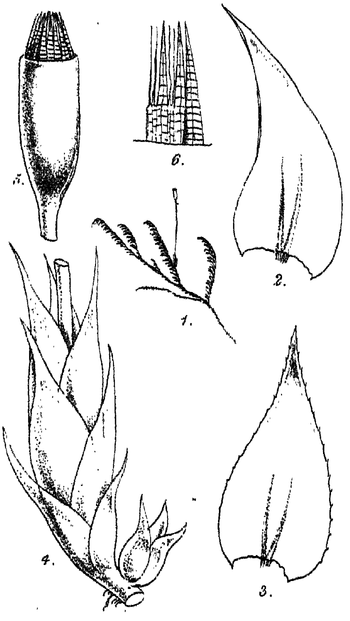
H. aggregatum.



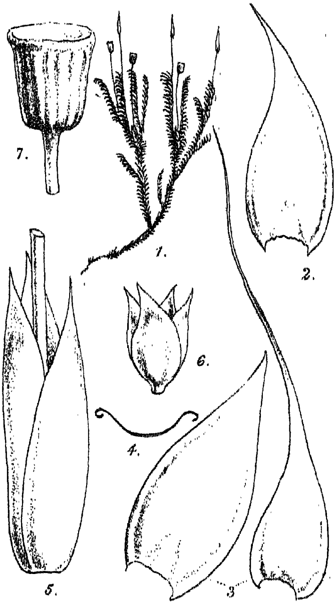
Pterogonium procurrens.



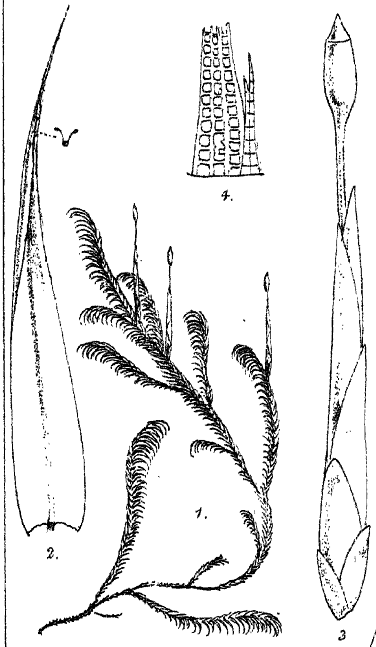
Stereodon plumifer.



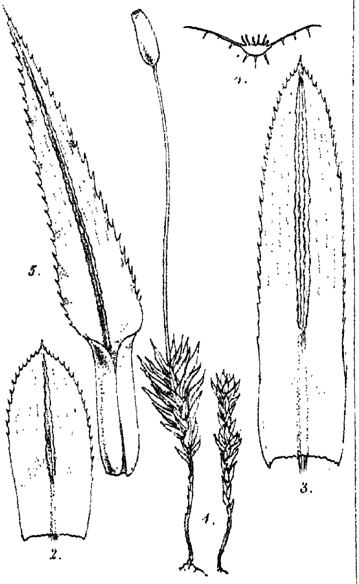
Stereodon geminus.



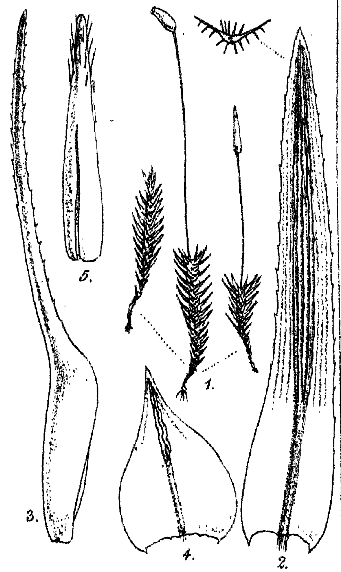
Hedwigia pilifera



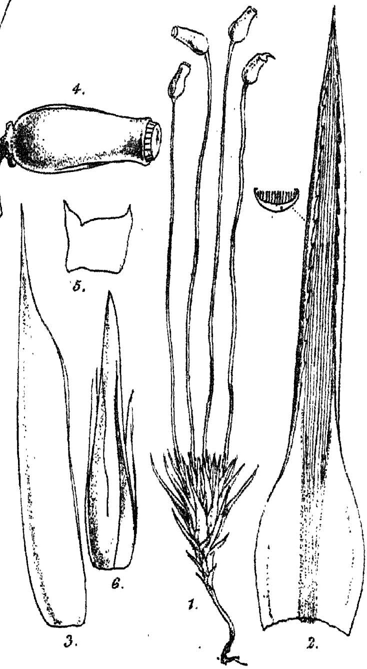
Dichelyma uncinatum.



Atrichum parallelum.



Oligotrichum aligerum.



Polytrichadelphus Lyallii.

### Plate VIII.

*Dichelyma uncinatum.*

1, plant, natural size.

2, leaf; 3, perichætium and capsule 4, portion of peristome: all magnified.

*Atrichum parallelum.*

1, plant, natural size.

2, leaf from the lower part; 3, the same from upper part of the stem; 4, transverse section of the middle of the latter; 5, perichætial leaf: all magnified.

*Oligotrichum aligerum.*

1, plant, natural size.

2, a leaf from the middle of the stem; 3, perichætial leaf; 4, perigonial leaf; 5, calyptra: all magnified.

*Polytrichadelphus Lyallii.*

1, plant, natural size.

2, leaf from the middle of the stem, with section; 3, perichætial leaf; 4, capsule; 5, section of same; 6, calyptra: all magnified.

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## Flora of the Jhelum District of the Punjab. By J. E. Tierney Aitchison, M.D., F.L.S.

[Read December 17, 1863.]

The following paper, which I have the honour to lay before the Society, is the result of observations made in the Jhelum District during the years 1859, 1860, and 1861, whilst acting as Civil Assistant-Surgeon in that district. The opportunities for botanical research throughout the district were not very numerous, from my medical duties requiring my presence at the headquarters of the district, viz. at the town of Jhelum; and when they did occur, it was generally not at a good season for the botanist. However, with the exception perhaps of that part of the Salt Range included in the district, the flora may be considered as tolerably complete.

From the position of the district of Jhelum—close to the base of the hills that surround Cashmere on the one hand, and on the other gradually extending in a south-westerly direction towards the Sind-Sagur and Jetch Dooabs, towards Edgeworth's Country—it forms a link of union between the Mooltan and Cashmere floras, the altitude of Mount Tilla and of the Salt Range giving us some of the botany to be met with on the lower range of the Himalaya.

The Jhelum District is bounded on the south by the river Jhelum, on the south-east by the Kharian hills, on the east and north-east by the bend of the Jhelum river (which is here the boundary between the British and Cashmere territories), on the north by the ravine-country of the Rawul Pindee district, and on the west by no natural division, but a line drawn from Shapore to Tullagung would be tolerably correct.

The eastern half of the district has the Bukrala and Ratian ranges of hills running through it, with, as already alluded to, the Kharian range, forming the south-eastern boundary. The average height of these three ranges of hills may be said to be 1100 feet above the sea-level.

Between the Ratian and Kharian ranges runs the river Jhelum: the Kharian range above the town of Jelallpore bends across to the river and ends on its bank, but is seemingly carried on in its course on the north of the river by the Surafer hills.

The Bukrala, Ratian, and Kharian hills (the last by means of the Surafer) unite to form the Salt Range, which at once rises to the height of 2000 feet, some parts averaging 2500 feet, and a few points come up to nearly 3000 feet above the sea-level.

One of the most westerly parts of the Ratian Range, Mount Tilla, rises to 3200 feet. This occurs, however, before this range joins to form the Salt Range.

The Salt Range formed from these three ranges of hills takes a westerly course towards the Indus river, cutting the western half of the Jhelum district into two parts—the portion between the hills and river, and the portion to the north of these hills.

The portion of the district lying on both sides of the river as it passes between the Ratian and Kharian hills consists of well-cultivated plains, through which pass the Boonah and Bukrala nullas. The botany of this part is decidedly that of the cultivated parts of the North-west Provinces. In the Kharian, Ratian, and Bukrala ranges of hills, of which I shall always hereafter speak as the low ranges of hills, there is no cultivation, but they are covered by a low jungle of *Acacia modesta* (stunted), *Capparis aphylla*, *Carissa diffusa*, *Grewia betulifolia*, *Sageretia Brandrethiana*, *Gymnosporia spinosa*, *Ehretia aspera*, &c., upon which large droves of cattle, sheep, goats, camels, &c., are sent to graze.

Between the Ratian and Bukrala ranges and the whole of the district to the north of the Salt Range and Bukrala hills, the land is extensively cut up by ravines and water-courses. The soil is very poor, and more or less saline, as shown by the presence of *Anabasis multiflora*, *Caroxylon fœtidum*, and *Tamarix*. There are here no trees but what are cultivated, and these, few in number, chiefly consist of *Acacia Arabica* and *Zizyphus Jujuba*. As we pass westwards, however, near Tullagung, trees are more plentiful —some even indigenous, as the Sissoo—and the soil richer, producing fine crops, chiefly of the pulses; indeed the grain of this part of the district supplies much of the Punjab. The crops about this ravine-country are very much more dependent upon rain than those of any other part of the district, from the soil being apparently quite incapable of retaining moisture. The characteristic botany of the ravines themselves is chiefly composed of *Nerium odorum*, *Saccharum spontaneum*, and *Butea frondosa*. In the uncultivated parts a very similar jungle to that found on the lower ranges of hills exists.

To the south of the Salt Range we have plains extending to the river, which, the further we get westwards from Jelallpore, become more saline in their nature, and, except close to the river's bank, with some other exceptional localities, gradually become devoid of cultivation, producing a jungle of *Tamarix*, *Salvadora*, *Prosopis*, *Capparis*, *Suæda*, *Anabasis*, &c. Where the soil is becoming highly charged with saline matter, amongst the most characteristic signs is the change of *Æluropus repens* for *Cynodon Dactylon* and the profusion of *Cressa Cretica*.

From Jelallpore towards Pind-dadan Khan the exception is to have soil incapable of cultivation, and what is cultivated is rich, producing fine crops, including sugar-cane as a field crop; this is not producible in any other part of the district. Besides, the soil, from its less elevation above the river, is very much moister, and, as a proof of this, rice is raised in some spots. Trees are plentiful and produce good timber; the Cypress variety of the *Acacia Arabica* is very characteristic.

Passing from Pind-dadan Khan westwards we very quickly come upon a country the greater part of the soil of which is incapable of cultivation, and is covered by a jungle of shrubs,—the portion that is cultivable being a narrow strip on the river's bank, which yields fair crops, with some timber, chiefly of *Acacia Arabica* and *Zizyphus Jujuba*, as also groves of Date-palms. This arable part is called the Kachi, and the part that is unfit for cultivation and covered with jungle, the Bar. In short, we have here a similar state of things to that met with in the Dooabs.

The Salt Range, from its elevation, has a very interesting flora. Besides the ridges of hills and valleys of which it is chiefly formed, it has, running through it, extensive plains of tableland which produce fine crops of wheat, greatly dependent, however, upon rain. On the occurrence of a dry season a complete destruction of the crops takes place. The ridges themselves are covered with a thickly wooded jungle of the Olive, *Dodonæa*, *Buxus*, as well as of the vegetation which occurs on the low ranges of hills.

Amongst the hills here and there we have springs of fresh water running through the valleys, which, as long as they run upon a stratum above the salt, give rise to a great luxuriance of vegetation. In these valleys we meet with much fertile soil, and have, for the first time, the cultivation of the Poppy to some extent. *Rhus integerrima*, producing good timber, with *Bombax heptaphyllum*, and in some localities the Mulberry and *Acacia modesta*, grow in great luxuriance; the Vine also is to be met with naturalized. In the fields of the tableland *Salvia Moorcroftiana* is found everywhere, besides *Edwardsia Hydaspica*, *Gypsophila Vaccaria*, *Lithospermum arvense*, *Lepidium*, &c.

Mount Tilla, the most westerly of the Ratian Range, has a more wooded appearance than any part of the Salt Range; for the latter is chiefly wooded in its valleys, whereas Mount Tilla, from apparently its greater moisture, is wooded all over, chiefly, however, where the altitude rises above 2000 feet, with trees of *Bombax*, *Rhus*, *Moringa*, *Olea*, *Acacia rubicaulis*, *Rottlera*, *Kydia*, *Cordia*, *Celtis*, &c. Besides these we have the following, dependent upon the altitude obtained, viz. *Galium*, *Geranium*, *Convolvulus*, *Cheilanthes*, and *Asplenium*. In addition to these we have *Punica Granatum*, naturalized, if not indigenous, and a solitary specimen of *Pinus longifolia*, introduced about thirty years ago. *Phœnix sylvestris* covers the hill on its western aspect from its base to its summit.

In conclusion, I beg to return my most sincere thanks to Dr. Thomas Thomson for the care and trouble he took in my behalf in naming and correcting my collection of plants, and to Dr. Joseph Dalton Hooker for the kind and very liberal manner in which he permitted me to make use of the Kew Herbarium and Library.

## *Flora of the Jhelum District of the Punjab.*

### THALAMIFLORÆ.

#### RANUNCULACEÆ.

Clematis Gouriana, *Roxb.* Mount Tilla only.
Delphinium saniculæfolium, *Boiss.* On Mount Tilla, rare.
Ranunculus aquatilis, *L.* Not common.
—— muricatus, *L.* Not common.
—— sceleratus, *L.* Very common.

#### MENISPERMACEÆ.

Cissampelos Pareira, *L.* Mount Tilla.
Cocculus Leæba, *Forsk.*

### NYMPHÆACEÆ.

Nymphæa alba, *L.*?
—— stellata, *Willd.*
—— Lotus, *L.*

### NELUMBIACEÆ.

Nelumbium speciosum, *Willd.* Common in ponds that have some depth of water.

### FUMARIACEÆ.

Fumaria parviflora, *Lam.*

### PAPAVERACEÆ.

Papaver somniferum, *L.* Cultivated on the plains upon the Salt Range.

### CRUCIFERÆ.

Brassica campestris, *L.* Cultivated largely as a field produce for the seed, from which, by simple expression, is obtained Surson oil.

—— Eruca, *L.* Cultivated largely for its seed, from which, by simple expression, is obtained black Surson oil—the oil obtained from this being much darker in colour than that of *B. campestris.* Another name for the dark oil is "Tarameera" oil.

The harvest for collecting the seed of the above two plants is about the end of June or beginning of July; but where irrigation is much resorted to, the crop is often collected as early as May and as late as October. With irrigation their cultivation may be carried on throughout the whole hot season.

Capsella Bursa-pastoris, *R. Br.*
Farsetia Jacquemontii, *H. f. & T.* Common in the Salt Plains.
Goldbachia lævigata, *DC.*
Lepidium sativum, *L.* Naturalized all over the district.
Malcolmia Africana, *R. Br.*
—— strigosa, *Boiss.* Plains upon Salt Range, frequent.
Nasturtium officinale, *L.*
Physorhynchus Brahuicus, *Stocks.* On the low ranges of hills rare, but common and characteristic over Mount Tilla and the Salt Range above 1500 feet from the sea-level.
Sisymbrium Irio, *L.*
—— Sophia, *L.*

### RESEDACEÆ.

Oligomeris glaucescens, *Camb.*

### CAPPARIDACEÆ.

Capparis aphylla, *Roxb.* A characteristic shrub over the whole district, called "Kureel:" an excellent firewood—burns readily even when green. The wood does well instead of box-wood for turning-purposes. The fruit is preserved by the natives as a sort of pickle, and called "Teuti."

—— spinosa, *L.* Common in the Salt Range.

Cleome icosandra, *DC.*
—— linearis, *Stocks.*
—— pentaphylla, *L.* Called "Hool-hool-sufaid."
—— ruta, *Jacq.*
Cratæva Roxburghii, *Br.* Called "Burna." The clammy mucilage of the fruit, as well as its rind, are used to make a cement: from the astringency of the latter it is used as a mordant in dyeing. The timber, although large, is of no value.

### VIOLACEÆ.

Viola cinerea, *Boiss.*
—— tricolor, *L.* Naturalized from cultivation.

### POLYGALACEÆ.

Polygala arvensis, *Willd.*
—— Vahliana, *DC.*

### CARYOPHYLLACEÆ.

Arenaria serpyllifolia, *L.*
—— ——, var. rotundifolia. Above the Fort of Mungla, on rocks covered with damp mould, on the banks of the river.
Gypsophila Vaccaria, *L.* Plains upon the Salt Range.
Mollugo cerviana, *Ser.*
—— nudicaulis, *L.*
Silene conica, *L.*
—— rubella, *L.* Escaped from cultivation.
Spergularia rubra, *Pers.*

### PORTULACACEÆ.

Portulaca oleracea, *L.* Called "Monkha."
—— quadrifida, *L.*

### LINACEÆ.

Linum usitatissimum, *L.* Cultivated for its seed only, which is collected in April, and from which is extracted, by simple expression, the oil. Called by the natives "Ulseeka thail."

### MALVACEÆ.

Abutilon Indicum, *G. Don.*
Gossypium herbaceum, *L.* Cultivated throughout the district, but not more than is required for local consumption. To produce a fibre of good quality, irrigation in this district is essential.
Hibiscus Gibsoni, *Stocks.* On Mount Tilla, above 2000 feet.
—— vitifolius, *L.* On Mount Tilla only; also cultivated in gardens.
Lagunea lobata, *Willd.*
Malva parviflora, *L.*
Sida cordifolia, *L.*
—— humilis, *L.*
—— rhombifolia, *L.*

### STERCULIACEÆ.

Bombax heptaphyllum, *L.* Mount Tilla and Salt Range, common. Called "Sembul."

Sterculia. Species not recognized, from absence of flower and fruit. This is a most characteristic shrub on Mount Tilla, at an altitude of above 2500 feet, from its conspicuous foliage.

### BYTTNERIACEÆ.

Kydia calycina, *Roxb.* Mount Tilla, above 2000 feet.

Melhania abutiloides, *Arn.* Profuse on Mount Tilla.

### TILIACEÆ.

Corchorus acutangulus, *L.*

—— olitorius, *L.* Not cultivated in this district.

—— tridens, *L.*

Grewia betulifolia, *Juss.* A characteristic shrub throughout the low ranges of hills.

—— oppositifolia, *Ham.* Mount Tilla, common at 2500 feet.

—— Rothii, *DC.* Mount Tilla, common.

—— villosa, *Roth.* Mount Tilla, not common.

Triumfetta angulata, *Lam.*

### MELIACEÆ.

Melia Azedarach, *L.* Cultivated. Called "Persian Lilac," "Buchyan," and "Dek."

### CEDRELACEÆ.

Cedrela Toona, *Roxb.* Cultivated. Called "Toon."

### SAPINDACEÆ.

Cardiospermum Halicacabum, *L.*

Dodonæa Burmanniana, *DC.* Profuse on the western aspect of Mount Tilla and on the Salt Range. Called "Syna."

### VITACEÆ.

Vitis carnosa, *Wall.*

—— vinifera, *L.* Cultivated, and upon plains above Salt Range apparently naturalized.

### GERANIACEÆ.

Geranium lucidum, *L.* Summit of Mount Tilla only.

—— rotundifolium, *L.* Summit of Mount Tilla only.

### OXALIDACEÆ.

Oxalis corniculata, *L.*

### ZYGOPHYLLACEÆ.

Fagonia Cretica, *L.*

Peganum Harmala, *L.* Called "Hoormul."
Tribulus terrestris, *L.*

### AURANTIACEÆ.

Feronia Elephantum, *L.* Cultivated.

## CALYCIFLORÆ.

### RHAMNACEÆ.

Rhamnus Persica, *Boiss.* Mount Tilla, rare.

SAGERETIA BRANDRETHIANA, n. sp. Foliis ellipticis, utrinque obtusis, tenuissime dentatis, subtus cinereo tomentosis.

A small shrub, with rigid, somewhat pubescent, generally opposite branches, often converted into spines. Leaves less than an inch long, and often much smaller, glabrous and dark green above, with a dense, woolly, whitish covering on their under surface. Flowers fascicled along the lateral branches as in the other species.

The densely whitish-woolly under surface of the leaves is diagnostic of this species from all the others of the genus.

A characteristic shrub of the low ranges of hills, called by the natives "Kohare." It is No. 105 of Fleming's Collection from the Salt Range, in the Kew Herbarium, which has the same native name.

Zizyphus Jujuba, *L.* "Baer." The leaves and fruit make good fodder for cattle, for which purpose it is cultivated. The branches make excellent hedges. The wood supplies the zemindar with his ploughs, well-wheels, and timber for his house. The tree yields a lac, called "Baree-kalak," used in dyeing.

—— Jujuba, var. hortensis, is rare in this district.

—— nummularia, *W. & A.* Common, and assists in forming much of the "Baer" jungles, which are preserved for fodder for cattle.

—— vulgaris, *Lam.* Not common. "Choya."

### CELASTRACEÆ.

Gymnosporia spinosa, *Hook. fil.* Called by the natives "Putaker." Very characteristic of the low ranges of hills.

### MORINGACEÆ.

Moringa pterygosperma, *Gaert.* Called "Sohounja" by the natives; the fruit used by them in their curries. The roots used by Europeans as a substitute for horse-radish, hence called "Horse-radish tree." Mount Tilla, common; also Salt Range. No oil extracted from the seed.

### ANACARDIACEÆ.

Mangifera Indica, *L.* Cultivated. "Mango."

Rhus integerrima, *Wall.* Called by the natives "Kuker-singha," from the horn-like appendages borne on its branches, caused by insects. Yields tolerably good timber, which is used for cabinet-work. Called "Zebra-wood" from the appearance presented by the wood. Mount Tilla and Salt Range, above 2000 feet.

## LEGUMINOSÆ.

Acacia Arabica, *L.* Common over the district, but not above the altitude of 1000 feet. Yields valuable timber, more especially for woodwork that is to be exposed to extremes of temperature with moisture, as that connected with wells. The branches make excellent fences; the soft leaves, flowers, and fruit yield fodder for cattle; the bark is used for tanning, and making country spirits; the small wood for charcoal; and the gum is valuable. It is called "Keekur" by the natives, and of it we have two varieties:—

Var. cupressina, which, from its peculiar form, can be distinguished miles off; and

Var. spina albida, in which the tree is covered with large white spines.

—— eburnea, *Willd.* Salt Range, not common.

—— Farnesiana, *Willd.* Cultivated. Flowers chiefly during the cold weather, with a strong, sweet perfume.

—— modesta, *Wall.* "Phulai." The timber is of great value, from its durability and hardness, for cog-wheels, &c. Grows as a characteristic shrub over the low ranges of hills, supplying a large portion of the firewood used in the district.

Albizzia Lebbek, *Benth.* Cultivated tree called "Sirrus."

Alhagi Maurorum, *DC.*

Alysicarpus nummularifolius, *DC.*

Argyrolobium roseum, *Jaub. & Sp.*

—— uniflorum, *Jaub. & Sp.* Mount Tilla, common.

Astragalus leucocephalus, *Benth.* On the Salt Range at 2000 feet above the sea-level, common.

—— multiceps, *Wall.* Characteristic of the low ranges of hills.

—— tribuloides, *Del.*

—— (species).

Bauhinia variegata, *L.* Cultivated. Called "Kochnar."

Butea frondosa, *Roxb.* Called "Dhak," and also "Plass." Is characteristic of the Ravine-country: much ground on which this grew is being reclaimed. The wood is used for firewood; the bark of the root is made into rope; the exuded resin (Indian Kino) is used medicinally by the natives, as well as for tanning and as a mordant in dyeing; the flowers as a dye; the leaves for wrapping up the various commodities sold in a bazaar, as fodder for elephants, and bedding for cattle.

Cassia acutifolia, *Del.* "Senna." Cultivated.
—— Fistula, *L.* Cultivated. "Amultas," Indian Laburnum.
—— mimosoides, *L.* Mount Tilla.
—— Tora, *L.* "Punwar."
Cicer arietinum, *L.* Cultivated. Yields the pulse called "Chunnah."
Crotalaria Burhia, *Ham.* Is characteristic of the Salt Plains. Rare in the low ranges of hills.
—— juncea, *L.* Cultivated in strips round fields. Called "Sunni," and yields a fibre called "Sunn."
—— medicaginea, *Lam.*
—— sericea, *Retz.* Cultivated.
Cyamopsis psoralioides, *DC.*
Dalbergia Sissoo, *Roxb.* Largely cultivated, yielding good timber. Found wild in ravines near Mount Tilla and Tullagung. Called "Sheshum."
Dolichos uniflorus, *Lam.*
Edwardsia Hydaspica, *Edgw.* In great quantity at Choya and Kutas. Called "Koon." No animals will feed on it; if cows do, they are poisoned by it.
Ervum Lens, *L.* Cultivated: yields the pulse called "Musoor."
Guilandina Bonducella, *L.* It is doubtful if this has not been introduced at Pind-dadan Khan, Kulla-kahar, &c. Called "Kut-karounga." Used as a febrifuge by the natives.
Indigofera cordifolia, *Heyne.*
—— linifolia, *Retz.*
—— Senegalensis, *DC.*
—— tinctoria, *L.* Cultivated chiefly in small quantities to dye the beards of the cultivators blue. Called "Neel."
Lathyrus annuus, *L.*
—— Aphaca, *L.*
Lespedeza cuneata, *Don.* On Mount Tilla only.
Medicago denticulata, *Willd.*
Melilotus parviflora, *Lesf.*
Mimosa rubicaulis, *Lam.* On Mount Tilla this takes the place of *Acacia Arabica,* as the latter begins to disappear upon reaching an altitude of above 1000 feet.
Mucuna (species not determinable). On Mount Tilla only, near the summit.
Nomismia aurea, *W. & A.*
Parkinsonia aculeata, *L.* Cultivated: is becoming naturalized.
Phaseolus aconitifolius, *L.* Cultivated. Yields the pulse called "Moth."
—— Mungo, *L.* Yields the pulse called "Mung."
—— trilobus, *Ait.* In great profusion on the eastern face of Mount Tilla.
Poinciana pulcherrima, *L.*
Prosopis spicigera, *L.* A characteristic tree throughout the Salt Range, as also amongst the jungle between these hills and the river Jhelum.

Not one specimen of this to be met with to the east of Jelallpore. Called "Jand" by the natives, who eat the green fruit largely.

Psoralea corylifolia, *L.* Rare. Called "Choya."

Rhynchosia minima, *DC.*

Sesbania aculeata, *Pers.*

—— Ægyptiaca, *Pers.* Cultivated: is becoming naturalized.

Tamarindus Indica, *L.* Cultivated. Called "Imlee."

Taverniera nummularia, *DC.* Characteristic shrub of low ranges of hills.

Tephrosia purpurea, *Pers.* A noxious weed.

—— tenuis, *Wall.* Mount Tilla only.

Trigonella incisa, *Royle.*

Vigna carinalis, *Benth.* Mount Tilla, near the summit.

Vicia sativa, *L.*

### ROSACEÆ.

Potentilla supina, *L.*

Rubus niveus, *Wall.* Found amongst stones at the water's edge, above the Fort of Mungla, in April,—its presence due to the seeds being carried down from their natural station to this locality by the river.

### DRUPACEÆ.

Amygdalus communis, *L.* Cultivated.

### POMACEÆ.

Cydonia vulgaris, *L.* Cultivated. Called "Bailee."

Pyrus Malus, *L.* Cultivated. Called "Sayoo."

### LYTHRACEÆ.

Grislea tomentosa, *Roxb.*

Lawsonia alba, *Lam.*

### MYRTACEÆ.

Punica Granatum, *L.* Cultivated in gardens. On the summit of Mount Tilla, apparently wild.

Syzygium Jambolanum, *DC.* Cultivated tree, called "Goulab Jaman."

### TAMARICACEÆ.

Tamarix dioica, *Roxb.* On islands in the river. Called "Pilchee," "Jhao," and "Furas." The term "Pilchee" is as frequently applied to reeds, "Furas" to the *T. Indica.* "Jhao" seems to be the most correct name. It yields a variety of galls called "Burree muee," a large export from the Mooltan district.

—— Indica=gallica, *L.* Occurs from a small bush to a large tree upon the most unfavourable soil for vegetable growth, and forms the greater part of the jungle in the Salt Plains. This, as well as *T. orientalis*, is called "Furas." The latter I am not aware of having met with, although this may be from not having seen it in flower to recognize it.

### TETRAGONIACEÆ.

Trianthema pentandra, *L.*

### ILLECEBRACEÆ.

Polycarpæa corymbosa, *Lam.*

### CUCURBITACEÆ.

Cucumis Colocynthis, *L.* Used by the natives as a purgative for horses: called "Indrawn."
—— utilissimus, *Roxb.*
Luffa amara, *Roxb.* Mount Tilla and Salt Range, very common.
Momordica dioica, *Roxb.*

### SAMYDACEÆ.

Casearia tomentosa, *Roxb.* Not common.

### UMBELLIFERÆ.

Apium graveolens, *L.* Kulla-kahar, Salt Range.
Coriandrum sativum, *L.*
Hydrocotyle Asiatica, *L.*
Pimpinella crinita, *Boiss.* Very common.
Ptychotis Coptica, *DC.* Field weed.
Torilis nodosa, *L.*

### CINCHONACEÆ.

Borreria lasiocarpa, *W. & A.*
Gardenia tetrasperma, *Roxb.* Mount Tilla and Kutas.
Hamiltonia suaveolens, *Roxb.* Mount Tilla. Called "Mud-maltee."
Hedyotis aspera, *Heyne.* Mount Tilla: profuse.

### GALIACEÆ.

Galium Aparine, *L.* Summit of Mount Tilla.

### COMPOSITÆ.

Aplotaxis candicans, *DC.*
Artemisia scoparia, *W. & K.*
Berthelotia lanceolata, *DC.* In great luxuriance near Chuckowal.
Bidens bipinnata, *L.* Mount Tilla.
Blainvillea latifolia, *DC.*
Blumea lacera, *DC.*
Carthamus tinctorius, *L.*
Centaurea Calcitrapa, *L.*
—— Cyanus, *L.*
Cichorium Intybus, *L.* Cultivated: called "Kasnee."
Conyza absinthifolia, *DC.*
Echinops echinatus, *Roxb.*
Eclipta erecta, *L.*
Erigeron Canadensis, *L.*

Filago Germanica, *L.*
Francœuria crispa, *Cass.* Rare.
Gnaphalium luteo-album, *L.* Near water, Choya.
Inula vestita, *DC.* On the summit of Mount Tilla.
Lactuca auriculata, *DC.*
Machlys hemisphærica, *DC.*
Microrhynchus nudicaulis, *Less.*
Picridium Tingitanum, *Desf.* On a rocky ridge between Mount Tilla and the village of Bagree.
Pluchea. Of this, two apparently new species were picked up, growing in great luxuriance (quite arborescent) upon the red clay marl, at the gorges of the Salt Range.
Sclerocarpus Africanus, *Jacq.* Mount Tilla, near the summit.
Sonchus arvensis, *L.*
—— asper, *L.*
Trichogyne cauliflora, *DC.*
Vernonia cinerea, *Less.*
Xanthium Strumarium, *L.*

### CAMPANULACEÆ.

Campanula canescens, *Wall.* Summit of Mount Tilla.

## COROLLIFLORÆ.

### PRIMULACEÆ.

Anagallis arvensis, *L.*
Androsace rotundifolia, *Ham.*
Samolus Valerandi, *L.* Plains upon Salt Range.

### OLEACEÆ.

Olea Europæa, *L.* (ferruginea, *Wall.*). Met with wherever the elevation is above 1500 feet from sea-level as a shrub, but at 3000 feet it is a well-formed tree: called "Cow" by the natives. The wood is chiefly used for handles of axes (koolharees), for turning-purposes, and as firewood. It constitutes a little of the jungle on the highest part of the low ranges of hills, forming the main part of that on the Salt Range.

### JASMINACEÆ.

Jasminum grandiflorum, *L.*
Nyctanthes arbor-tristis, *L.* Cultivated. Called "Harsingar."

### APOCYNACEÆ.

Carissa diffusa, *Roxb.*
Nerium odorum, *Sol.* Called "Kuniyoor dafiee."
Rhazya stricta, *Dne.* In soil much impregnated with saline matter,

chiefly where the gorges of the Salt Range open out into the plains; also forming part of the jungle in the Salt Plains.

Thevetia neriifolia, *Juss.* Cultivated.

### ASCLEPIADACEÆ.

Boucerosia Aucheri, *Dne.* Over all the hills of the district, chiefly low ranges: called "Choonga." The natives eat it largely in an uncooked state.

Calotropis procera, *R. Br.* Called "Ak" and "Madar."

Dæmia extensa, *R. Br.* Mount Tilla.

Pentatropis spiralis, *Edgw.*

Periploca aphylla, *Dne.* Forms a large part of the jungle on the low ranges of hills. Very greedily eaten by goats, &c.

### GENTIANACEÆ.

Erythræa ramosissima, *Pers.* Near Fort Mungla.

### CONVOLVULACEÆ.

Batatas pentaphylla, *Choisy.*

Convolvulus arvensis, *L.*

—— pluricaulis, *Choisy.*

——, n. sp. Very near *C. saxatilis*, if it is not identical with it. On limestone formation, between Kula-kahar and Surdee.

Cressa Cretica, *L.* A very characteristic plant over the Salt Plains, commencing to the west of Jelallpore.

Evolvulus alsinoides, *L.*

Ipomæa muricata, *Roxb.*

—— pilosa, *Choisy.* Summit of Mount Tilla.

—— sessiliflora, *Roth.*

Pharbitis Nil, *Choisy.* Summit of Mount Tilla. Yields the seed "Kaladana" used as a purgative by the natives.

Rivea ornata, *Choisy.*

### CUSCUTACEÆ.

Cuscuta reflexa, *Roxb.* Called "Akas-bel."

### CORDIACEÆ.

Cordia latifolia, *Roxb.* Lessoora, cultivated.

—— Myxa, *L.* Cultivated.

—— vestita, *H. f. & T.* One tree only of this in the district, on Mount Tilla; this apparently introduced.

### BORAGINACEÆ.

Anchusa hispida, *Forsk.*

Arnebia hispidissima, *DC.*

Bothriospermum tenellum, *F. & M.* Where the Chumuck joins the Jhelum River.

Cynoglossum micranthum, *Desf.*
Lithospermum arvense, *L.* Corn-fields upon Salt Range, common.
Nonnea pulla, *DC.*
Trichodesma Indicum, *R. Br.*

### EHRETIACEÆ.

Ehretia aspera, *Roxb.* Called "Chumror" and "Kookhun."
Heliotropium Europæum, *L.*
—— strigosum, *Willd.*
—— strigosum, var. linifolium.
—— undulatum, *Vahl.*

### SOLANACEÆ.

Datura fastuosa, *L.* Called "Datoora."
—— Stramonium, *L.* Naturalized.
Lycopersicum esculentum, *L.* Cultivated.
Physalis minima, *L.* Asgund.
Solanum gracilipes, *Jacq.*
—— Jacquini, *Willd.* Called "Kuthelee-kunth."
—— nigrum, *L.*
—— sanctum, *L.* Common.
Withania coagulans, *Dun.* Rare.
—— somnifera, *Dun.*

### BIGNONIACEÆ.

Amphicome Emodi, *Royle.* Mount Tilla and Fort Mungla.
Tecoma undulata, *G. Don.* Low ranges of hills and ravines: common. Called "Loora."

### SCROPHULARIACEÆ.

Antirrhinum Orontium, *L.*
Buddleia Neemda, *Roxb.* Fort Mungla.
Celsia Coromandeliana, *Vahl.*
Herpestes Monnieri, *H. B. K.*
Linaria ramosissima, *Wall.* Characteristic of the low ranges of hills and ravines.
—— triornithophora, *Willd.* Cultivated.
Lindenbergia macrostachya, *Benth.* Near river Jhelum, Fort Mungla.
—— polyantha, *Royle.*
—— urticæfolia, *Lehm.* Mount Tilla.
Mazus rugosus, *Lour.*
Mimulus gracilis, *R. Br.* Not common: near river and tanks.
Scrophularia scabiosæfolia, *Benth.* Ravines near Chuckoa.
Striga euphrasioides, *Benth.* Rare. Mount Tilla.
Veronica agrestis, *L.*
—— Anagallis, *L.*
Verbascum Thapsus, *L.*

### ACANTHACEÆ.

Justicia Adhatoda, *L.* Characteristic over the whole district. Called "Bansa" and "Bakoor" by the natives. No animal will eat it.
Barleria cristata, *L.* Mount Tilla and Salt Range, common.
Dicliptera Roxburghiana, *Nees.*
Dipteracanthus prostratus, *Nees.*
Rostellaria peploides, *Nees.*

### PEDALIACEÆ.

Sesamum Indicum, *L.* Cultivated in fields for its seeds, called "Tillee." The oil obtained from its seeds called "Til-ka-thail."

### LABIATÆ.

Anisomeles ovata, *R. Br.* Not common. Duriala.
Ballota limbata, *Benth.* Characteristic of the low ranges of hills.
Colebrookia oppositifolia, *Sm.* Mount Tilla and Salt Range, not below 2000 feet.
Eremostachys Vicaryi, *Benth.* At Choya only.
Lallemantia Royleana, *Benth.* Abundant near the Fort of Rhotas; rare over the rest of the district. Quite wild.
Lamium amplexicaule, *L.*
Leucas cephalotes, *Spr.*
—— nutans, *Spr.*
—— urticæfolia, *Benth.*
Micromeria biflora, *Benth.* Abundant near Fort Mungla.
Nepeta ruderalis, *Ham.* Mount Tilla, common.
Ocimum Basilicum, *L.*, var. thyrsiflorum. Cultivated.
—— sanctum, *L.* Low ranges of hills, common.
Plectranthus rugosus, *Benth.* In great luxuriance on Mount Tilla.
Salvia Moorcroftiana, *Wall.* The plains upon Salt Range, in great abundance throughout the fields. Called "Kalather."
—— plebeia, *R. Br.* Summit of Mount Tilla.
—— pumila, *Benth.* Very characteristic of low ranges of hills and ravines. Sheep very fond of it.
Stachys parviflora, *Benth.* Plains upon the Salt Range.

### VERBENACEÆ.

Clerodendron phlomoides, *L.*
Duranta Plumieri, *L.* Cultivated.
Lantana alba, *Mill.* Common upon all the hills.
Lippia nodiflora, *Rich.*
Verbena officinalis, *L.*
Vitex Negundo, *L.* Mount Tilla only, on its summit.

### PLANTAGINACEÆ.

Plantago amplexicaulis, *Cav.*

Plantago ciliata, *Desf.*
—— decumbens, *Forsk.*

### PLUMBAGINACEÆ.

Plumbago Zeylanica, *L.* On Mount Tilla. Not common on Salt Range.

### SALVADORACEÆ.

Salvadora oleoides, *Dne.* Is only to be met with on the western aspect of the Surafer and the southern of the Salt Range hills, and the plains extending from the bases of these hills towards the river. It forms a very large part of the "Bar" jungle, and is called "Pelu." The fruit is eaten by the natives.

## MONOCHLAMYDEÆ.

### POLYGONACEÆ.

Polygonum aviculare, *L.*
—— barbatum, *L.*
—— Persicaria, *L.*
Rumex acutus, *Roxb.*
—— vesicarius, *L.* In the gorges leading from the Salt Range, in the beds of salt-water streams: common.

### NYCTAGINACEÆ.

Boerhaavia diffusa, *L.*
—— repanda, *Willd.* Mount Tilla only.

### CHENOPODIACEÆ.

Anabasis multiflora, *Moq.* Salt Plains.
Atriplex laciniata, *L.* Near Doomun.
Caroxylon fœtidum, *Moq.* This plant, with *Suæda fruticosa, L.*, and *Anabasis multiflora*, occupies large tracts of land that are incapable of producing useful vegetation, from Jelallpore, where we occasionally meet with them, passing westwards to the Salt Plains, where, with the larger jungle, they seem to be the only vegetable products. From this plant, by burning, is obtained "Sudgee," a coarse carbonate of potash and soda.
Chenopodium album, *L.*
—— murale, *L.*
Suæda fruticosa, *L.* Salt Plains.

### PHYTOLACCACEÆ.

Giesekia linearifolia, *Moq.*
Limeum Indicum, *Stocks.*

### AMARANTACEÆ.

Achyranthes aspera, *L.*
Ærua Javanica, *Juss.*

Ærua scandens, *Juss.*
Alternanthera sessilis, *R. Br.*
Celosia argentea, *L.*
Digera arvensis, *Forsk.*
Euxolus viridis, *Moq.*, var. caudatus.
Mengea tenuifolia, *Moq.*
Pupalia lappacea, *DC.*

### LAURACEÆ.

Tetranthera Roxburghii, *Nees.* Mount Tilla: not common; not cultivated.

### EUPHORBIACEÆ.

Andrachne telephioides, *L.* River side, above Mungla: common.
Baliospermum Indicum, *Dne.*
Buxus sempervirens, *L.* Salt Range: common. Called "Pupper." The branches with the leaves on used to thatch houses, as the leaves do not decay easily: wood only used as firewood.
Crozophora tinctoria, *Juss.*
Euphorbia Chamæsyce, *L.*
—— dracunculoides, *Lam.*
—— Helioscopia, *L.*
—— hypericifolia, *L.*
—— Nepalensis, *Boiss.*
—— thymifolia, *L.*
Phyllanthus Emblica, *L.* Called "Horola." Cultivated.
—— Niruri, *L.* Mount Tilla only.
Ricinus communis, *L.* The oil is not extracted from the seed in this district, but the seeds are eaten in curries by the natives. Called "Arund" and "Bed-ungeer."
Rottlera tinctoria, *Roxb.* Mount Tilla: common. Called "Rovin," "Roolee," and "Kameela." The red epidermis of the fruit is recognized as a vermifuge for the tape-worm by the natives, and also used as a dye.

### ULMACEÆ.

Celtis Caucasica, *Willd.* Mount Tilla, common, showing good timber at above 2500 feet.

### SALICACEÆ.

Populus Euphratica, *Oliv.* Cultivated: rare: good trees at Goozerat.
—— dilatata, *Ait.* Cultivated, Sofaida.
Salix Babylonica, *L.* Cultivated. Called "Mujnoo."

### CANNABINACEÆ.

Cannabis sativa, *L.*

### URTICACEÆ.

Forskolea tenacissima, *L.* Mount Tilla and Salt Range.

### MORACEÆ.

Ficus caricoides, *Roxb.* Called "Goojratee Anjeer."
—— Indica, *L.* Called "Bore, Burgot."
—— infectoria, *Willd.*
—— religiosa, *L.* Called "Pipul."
Morus alba, *L.* On the plains upon the Salt Range, near water. This is a fine tree; but in all other parts of the district, unless in gardens, it is but a stunted withered shrub. Called "Toot."
—— lævigata, *Wall.* Cultivated for its fruit in gardens.

### PINACEÆ.

Pinus longifolia, *Lamb.* On Mount Tilla one fine specimen, introduced. Called "Cheer."

## ENDOGENS.

### ARACEÆ.

Typhonium (species not determinable). Mount Tilla, at 3000 feet.

### JUNCAGINACEÆ.

Potamogeton crispus, *L.*

### ALISMACEÆ.

Alisma Plantago, *L.*
Sagittaria cordifolia, *Roxb.*

### ORCHIDACEÆ.

Zeuxine sulcata, *Lindl.*

### PALMACEÆ.

Chamærops Ritchiana, *Griff.* Very rare.
Phœnix dactylifera, *L.* Cultivated on river's bank; in some places quite naturalized, as at Pind-dadan Khan. Called "Kujoor."
—— sylvestris, *Roxb.* Mount Tilla, chiefly on its western slope.

### LILIACEÆ.

Allium rubellum, *Bieb.* Common over all the hills.
Asparagus Curillus, *Roxb.*
—— racemosus. *Willd.* Called "Eilora."
And other species.
Asphodelus fistulosus, *L.*
Scilla (species). At Bagree.

### COMMELYNACEÆ.

Commelyna Bengalensis, *L.*
—— communis, *L.*

### JUNCACEÆ.

Juncus bufonius, *L.*

## CYPERACEÆ.

Cyperus Haspan, *L.*
—— mucronatus, *Roth.*
—— niveus, *Retz.* Called "Deela."
—— rotundus, *L.*
Eleocharis palustris, *Br.*
Eriophorum comosum, *Wall.* Mount Tilla and Salt Range. Called "Babeela." Used for making ropes.
Isolepis barbata, *Br.*
Scirpus maritimus, *L.*

## GRAMINACEÆ.

Æluropus repens, *Trin.* Characteristic of soil charged with saline matter. Commencing to the west of Jelallpore, where this begins, we lose *Cynodon Dactylon.*
Andropogon annulatus, *Forsk.*
—— Sorghum, *Brot.* Largely cultivated: called "Jowar."
Anthistiria anathera, *Nees.* Mount Tilla, over the whole hill.
Apluda aristata, *Roxb.*
Aristida depressa, *Retz.*
—— murina, *Cav.*
Arundo Donax, *L.* Cultivated, and also naturalized: used for basket-work.
Avena fatua, *L.*
Bambusa arundinacea, *Retz.* Mount Tilla, in a valley to the south-west. Called "Bansa." Quite wild.
Batratherum molle, *Nees.*
Bromus arvensis, *L.*
Chrysopogon serrulatus, *Trin.*
Cymbopogon laniger, *Desf.* Called "Babul."
Cynodon Dactylon, *Pers.*
Dactyloctenium Ægyptiacum, *Willd.* Called "Madana."
Digitaria sanguinalis, *Scop.* Thurknee.
Eragrostis cynosuroides, *Beauv.*
—— plumosa, *Link.*
—— poæoides, *Beauv.*
—— verticillata, *Beauv.*
Heteropogon contortus, *R. & S.*
Hordeum hexastichum, *L.* Cultivated largely. Called "Jhow."
Kœleria phleoides, *Pers.* If this grass were cultivated, it would be of great use during the cold weather for fodder.
Lappago biflora, *Roxb.*
Melanocenchris Royleana, *Nees.*
Oryza sativa, *L.* Cultivated near Pind-dadan Khan.
Panicum antidotale, *Retz.*
—— colonum, *L.* Also cultivated. Called "Shamack."

Panicum Petiverii, *Trin.*
—— procumbens, *Nees.*
Penicillaria spicata, *Willd.* Largely cultivated. Called "Bajree."
Pennisetum cenchroides, *Rich.*
Polypogon Monspeliensis, *L.*
Rottboellia glabra, *Roxb.*
Saccharum cylindricum, *Lam.*
—— Munja, *Roxb.* Also cultivated for making rope. Called "Moonj."
—— officinarum, *L.* Cultivated to some extent near Jelallpore. Called "Gunnah."
—— spontaneum, *L.* On the islands and ravines.
Setaria glauca, *Beauv.*
Triticum æstivum, *L.*, and vars. Called "Gehun." Largely cultivated.
Zea Mays, *L.* Cultivated chiefly as a garden crop. Called "Makhee."

### POLYPODIACEÆ.

Adiantum Capillus-Veneris, *L.* In wells.
—— caudatum, *L.*
Asplenium Dalhousiæ, *Hook.* Mount Tilla: common.
Cheilanthes farinosa, *Kaulf.* Mount Tilla: common near the summit.

### MARSILEACEÆ.

Marsilea quadrifolia, *L.*

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## On a remarkable Species of *Cissus* from the South of Benguella, with remarks on the *Ampelideæ* of Angola and Benguella. By Dr. WELWITSCH, A.L.S.

[Read Dec. 17, 1863.]

AMONG the numerous groups of plants which more or less affect the physiognomy of the vegetation of Western Africa the Ampelideæ and Cissaceæ hold a prominent position. They are interesting also to phytographists, from the fact that the numerous species of *Cissus*, by their varied habit and mode of growth, characterize the three great botanical regions into which, in my opinion, the district of Angola and Benguella must be divided.

The entire number of species of Ampelideæ found by me in the above-named countries amounts to about forty, in which, however, are included two species of *Leea*, and a very remarkable plant which occurs upon the high sandy plains of the district of Ambaca, and which ought probably to constitute a new genus.

These forty species of Ampelideæ are spread over a space of

300 miles from east to west, commencing with the burning sandy steppes of the Atlantic coast region, and extending into the richly-wooded, cool, elevated plains of the interior. Throughout this space the number of species increases gradually, and the number of individuals becomes continually greater. With regard to their geographical distribution, it is found that the species with thick sappy fleshy stems preponderate in the littoral region (0–1000 feet alt.), those with elongated twining stems in the region of the primeval forests, and the species with upright, scarcely twining stems in the highest region of the elevated plains of the interior. Thus the species "*caule stanti*" are very rare in the littoral region, and are still more rare in the primeval-forest region, whilst almost all the species which are found in the region of the elevated plains exhibit a short upright stem, without any tendency to scramble or climb.

A second characteristic accompanying the geographical distribution of the Angola species of *Cissus* is the hairy covering of the stem and leaves. The species of the littoral region for the most part exhibit bright green, only slightly hairy stems and leaves, whilst the species of the primeval-forest region are characterized by dark-green shining foliage and more or less leathery, sometimes even evergreen leaves. On the other hand, in almost all the species of the region of the elevated plains, as for instance around Pungo-Andongo and Huilla, a thick hairy, or even felt-like, covering is seen on the stem and leaves. In a species which occurs upon the gneiss-rocks of Pungo-Andongo this latter covering forms such a thick golden-brown pile*, that the entire plant has the appearance of being hewn out of pure copper, and is indisputably one of the most beautiful of the vegetable productions of Angola. I have (provisionally) called this lovely species, which I believe to be undescribed, *Cissus Livingstoniana*, wishing thereby to indicate the fact (so important for geography) of this distinguished traveller having once visited Pungo-Andongo.

I purpose, with the kind permission of the Linnean Society, upon some other occasion, to lay before them this latter species, as well as the other notable forms or species collected by me in West Tropical Africa. For the present I confine myself to the description of a very remarkable species which occurs in the southernmost part of Benguella, in the district of Mossamedes, the same region where the Welwitschia grows†.

* Folia cupreo-velutina aureo-nitentia.

† The paper was accompanied by a living specimen (which has since flowered

## AMPELIDEÆ.

### Sectio Tetrandræ quinquefoliolatæ.

### CISSUS MACROPUS, n. sp.

Arbor pygmæa, 1–2½-pedalis, tota succulenta. *Truncus* bulbum ingentem, ovato-conicum apice bi- rarius tri-brachiatum mentiens, cortice lævigato herbaceo-viridi et epidermate pergamentacea albo-badia tectum, lamellis epidermatis uti in *Betula* sensim sese decorticantibus. *Radix* e fibris longis, cylindricis, subsimplicibus constans. *Rami* breves ⅓- usque ½-pedales, 2–4 pollic. crassi apice demum abrupte in ramulos circiter pedales, foliis et floribus ornatos abientes. *Cirrhos* nullos hucusque observavi. *Ramuli* obiter striati, patentissimi et, uti folia atque petioli, villis albidis arachnoideis in juventute obsiti, demum glabrescentes, digiti crassitudine, et uti omnis planta succo aquoso scatentes. *Folia* (novella plicata albo-tomentosa) longe petiolata, infimum ramuli 3-, reliqua 5-foliolata, foliolis ovato-ellipticis vel obovatis, breviter petiolulatis, inæqualiter dentatis, utrinque arachnoideo-pubescentibus, supremum longius petiolulatum usque 4 vel 5 uncias longum, infima basi inæquilateralia, reliqua basi plus minus subcordata. *Stipulæ* ad basin petioli binæ, oppositæ, lato-lanceolatæ, acuminatæ, deciduæ. *Pedunculi* axillares vel abortu terminales, petiolorum circiter longitudine, leviter striati, patentes, petiolis tenuiores, dichotomo-ramulosi, ramulis oblique erectis corymbum latiusculum formantes. *Flores* 4-meri, ex flavo viridescentes, parvuli. *Calyx* brevissimus, obsolete dentatus, dentibus vix semper bene distinctis. *Corolla* tetrapetala, induplicato-valvata; petala carnosa apicibus induplicatis, per paria cohærentia, calyptratim decidua, apice valde cucullata, albida, sat fugacia. *Discus* valde evolutus, e tuberculis quatuor inter se distinctis columnaribus, apice oblique truncatis, ibidemque aurantiaco-glandulosis constans, post anthesin demum auctus. *Stamina* 4; antheræ obovatæ, incumbentes, luteolæ. *Ovarium* ovatum vel ovato-conicum disci tuberculis superatum, biloculare. *Stylus* sub anthesi staminum longitudine, firmus, rectus, stigmate simplici (nec capitato!) terminatus. *Fructum*, quem nondum observare mihi licuit, baccam esse dicunt, pisi mole, rubro-violaceum.

*Hab.* Sporadica in rupestribus (subsalsis!) de *Serra dos Montes Negros* prope Mossamedes, nec non in montibus aridis de *Giraul* versus orientem ad 400 usque 600 ped. altit. super mare.

Culta Olisipone floruit Apr. et Maio, quod est tempus autumni in ditione patriæ.

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at the Royal Gardens, Kew, and will be published by Sir W. Hooker in the Botanical Magazine for 1864) and a dried flower of the plant described.

# Observations on the Functions and Structure of the Reproductive Organs in the *Primulaceæ*. By Mr. JOHN SCOTT, Royal Botanic Gardens, Edinburgh. Communicated by CHARLES DARWIN, Esq., F.R.S. & L.S.

[Read Feb. 4, 1864.]

IN the paper which I have the honour to submit to the Society, my principal object is to give an account of a few experiments, made chiefly in the course of the present year, on several of the "*dimorphic*" and "*non-dimorphic*" species of *Primula*, the remarkable sexual relations of which were entirely unknown until Mr. Darwin laid before this Society his interesting paper on the subject. I have also, with the view of more completely elucidating the subject of dimorphism in the Primulas, prefixed to these a brief account of the structure and indications of the resultant functions in a few other genera of the order, which may not be uninteresting, as apparently showing that those sexual relations manifested in the genus *Primula* are common to other genera of the order*.

1. The genus *Hottonia* presents dimorphic characteristics in at least its solitary British representative, the common Water-Violet, *H. palustris.* Of this plant I can say little from personal observations, but, through the kindness of Mr. Darwin, who obligingly sent me his manuscript account of it, I am enabled to add, from his observations, the following interesting account of its structural dimorphism:—"Various authors have remarked that the *Hottonia palustris* presents two forms. Fresh specimens sent to me from North Wales were grandly dimorphic. In the long-styled form the pistil is more than twice as long as in the other form, and projects far out of the flower; the stigma is smaller and rougher than that of the short-styled, and the anthers lie within the tube of the corolla. In the short-styled form the

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* I will here take the opportunity to acknowledge my great obligations to Mr. M'Nab for the privilege I have, under him, enjoyed in carrying on the experiments which I am now about to detail, the majority of which were performed upon plants in the Royal Botanic Gardens here.

I am also in the present instance, as in many others, particularly indebted to Mr. Sterling, of Stockbridge, Edinburgh, for the facilities he has afforded me in the following out my experiments, by placing at my disposal his fine collection of plants.

anthers project far out of the flower, and correspond in height with the projecting stigma of the other form, as does the short pistil with the short stamens of the long-styled form. But the most remarkable difference is in the size of the pollen-grains: those from the short-styled flowers, when distended with water, are $\frac{14}{14000}$ of an inch in diameter; those from the long-styled (and therefore from the shorter stamens) are $\frac{9}{14000}$ in diameter. Spheres differing in the proportion of 14 to 9 in diameter presented under the microscope a most remarkable contrast. The contents of the larger pollen-grains seemed to be coarser-grained and of a browner colour."

To these structural observations of Mr. Darwin I may add a few experiments which I have lately had an opportunity of making upon a "short-styled" plant of this species, which, though worth little, afford more than a negative presumption that the above-described morphological peculiarities are also, as in the genus *Primula*, connected with remarkable functional relations. My experiments were limited to two racemes. In one I fertilized twelve flowers with own pollen; these yielded six capsules, *five* of which were good, and contained in all *thirty-seven* seeds. The other raceme I fertilized with pollen sent me of a long-styled form. The results from eight flowers thus fertilized were, *five good capsules*, and *one hundred and fifty-four seeds*. Thus, in the "*homomorphic unions*"—or union with own-form pollen—the average production of seeds per capsule is about *seven*, while in the "*heteromorphic union*"—or that resulting from the union of the two forms—we find the average of seeds per capsule increased to thirty and upwards.

Before passing from this genus, I may state that the *H. inflata* of North America does not present structurally dimorphic characteristics, however it may be as respects function. In specimens which I have examined, I found the style very short, and reaching the base of the anthers; the pollen-grains very similar as respects size, *i.e.* judging from dried specimens, to those of the "long-styled" form of *H. palustris*.

2. The genus *Primula* has, along with a great majority of truly "dimorphic" species, others in which I have observed the one form only; also a few with stamens and pistils of an equal length—"*non-dimorphic.*" In the following list I have enumerated all the species of *Primula* which I have had an opportunity of examining, and arranged them in accordance with my observations on the structure of their sexual organs. The first list

comprises the truly "dimorphic" species. They are as follows:—

### No. 1. *Dimorphic Species.*

Primula Altaica, *Lehm.*
—— amœna, *Bieb.*
—— aretioides, *Lehm.*
—— Auricula, *Linn.*
—— capitata, *Hook.*
—— Carniolica, *Jacq.*
—— cortusoides, *Linn.*
—— denticulata, *Smith.*
—— elatior, *Jacq.*
—— farinosa, *Linn.*
—— Finmarchica, *Jacq.*
—— glaucescens, *Morett.*
—— glutinosa, *Linn.*
—— Helvetica, *Don.*
—— hirsuta, *Dec.*
—— integrifolia, *Linn.*
—— involucrata, *Walk.*
—— latifolia, *Lapeyr.*
Primula macrocalyx, *Bunge.*
—— marginata, *Curt.*
—— minima, *Linn.*
—— Pallinurii, *Petagn.*
—— Pedemontana, *Thom.*
—— petiolaris, *Wall.*
—— pubescens, *Jacq.*
—— purpurea?
—— Sibirica, *Jacq.*
—— Sikkimensis, *Hook.*
—— Sinensis, *Lindl.*
—— Stuartii, *Wall.*
—— stricta, *Horn.*
—— venusta, *Hook.*
—— veris, *Linn.*
—— villosa, *Jacq.*
—— viscosa, *All.*
—— vulgaris, *Smith.*

### No. 2. *Short-styled Species.*

Primula floribunda, *Wall.*
—— Pallindhm?
—— pusilla, *Goldie.*
—— rosea, *Bot. Mag.*
Primula saxifragifolia, *Lehm.*
—— rupestris?
—— nivalis, *Pall.*

### No. 3. *Long-styled Species.*

Primula intermedia, *Curt.*
—— Flœrkeana, *Schr.*
—— longifolia, *Curt.*
Primula Mistassinica, *Mich.*
—— Pallasii, *Lehm.*
—— pulverulenta?

### No. 4. *Non-Dimorphic Species.*

Primula elata, *Hook.*
—— longiflora, *All.*
—— mollis, *Hook.*
Primula Scotica, *Hook.*
—— Sibirica, var. β, *Bot. Mag.*
—— verticillata, *Forsk.*

The first of the above lists comprises all the species of *Primula* in which I have observed the dimorphic characteristics in full; the two following are respectively enumerations of those species presenting, first, the *short-styled*, and second, the *long-styled* form only; but this may be due to my limited researches, and perhaps those who have an opportunity for more extensive researches will find them truly dimorphic likewise. Space will not permit, nor indeed is it requisite, that I should enter into details as to the relative structure of the sexual organs of these species, and this the more especially because a few of them will come under special treatment in the sequel. I will here, therefore, simply remark, that the individual characteristics of all the above species, with two exceptions, were so decided as to leave no doubt as to which form they should be referred. The species which presented the exceptions were the *P. pusilla* and *P. floribunda*, in both of which along with normal "short-styled" forms I have observed an individual with stamens and pistils of an equal length. I have only seen six specimens of *P. pusilla*, five of which had the anthers surrounding the mouth of the corolla-tube, the pistil about half the length of the latter. In the other specimen the anthers were similarly attached, but in this case the stigma reached their base. The case of *P. floribunda* is exactly similar, one specimen having the stamens and pistils of an equal length; the others were "short-styled"—the anthers reaching the mouth of the corolla-tube, the pistils about half the length of the latter.

These lists then show us that "*dimorphism*" is a very general characteristic of the sexual organs of the species of *Primula*; it is not, however, *universal*, as Mr. Darwin informs me Prof. Treviranus has stated (Bot. Zeit. 1863, p. 4) on the authority of Koch and Tausch. This will be seen by referring to the fourth of the above lists, where the names are given of those species presenting, from personal observations, no structural dimorphism, stamens and pistils being of an equal length. I had no intention of entering into special details as to the relative structure of the sexual organs in these species; since the above diametrically opposite assertion, however, has been made, I cannot thus summarily pass them over. I will therefore give a brief account of the relations of the anthers and stigmas in each.

First, *Primula elata.*—Of this species a single specimen only has come under my observation. In it the stamens are attached immediately below the mouth of the corolla-tube, anthers included; the stigmas in a number of the flowers reach the middle, in the others the base of the anthers.

Second, *Primula longiflora.*—In this species the anthers invariably surround the mouth of the corolla-tube, the stigmas either very slightly exserted, or more frequently of an equal length with the anthers.

Third.—*Primula mollis* differs from its immediate allies the *P. Sinensis* and *P. cortusoides* (truly dimorphic species) in presenting an equality in the length of the sexual organs. The anthers are attached to the tube of the corolla about one-third below its mouth, and closely surround the flattened disk-shaped stigma, which usually reaches their apices.

Fourth.—*Primula Scotica* affords us an indigenous illustration of the "non-dimorphic" structure. In native specimens I find the anthers usually surround the mouth of the corolla-tube, while in cultivated specimens I have in general found them attached about one-third below its mouth; in either case, however, the length of the style varies similarly, the stigmas in both being closely appressed by the anthers.

Fifth, *Primula Sibirica.*—Of this species two varieties are known, one with oblong entire leaves, the other with ovate crenated leaves. I have examined a number of native specimens of the former variety, all of which were truly dimorphic; of the latter I have seen cultivated specimens only, which, on the other hand, had stamens and pistils of an equal length. Whether native specimens of the latter are similarly characterized I know not; but it is not at all improbable that the "non-dimorphic" structure in the cultivated specimens is due to an abnormal development, as I have frequently observed flowers on distinct plants with the anthers assuming a petaloid form. Mr. Darwin in his paper above referred to (p. 81) mentions a case of non-dimorphism also in this species; he suggests, however, that it may possibly be due to an abnormal development of the anthers. Until further evidence is afforded of the structural condition of the *P. Sibirica*, var. $\beta$, from native specimens, I will therefore place it provisionally amongst the non-dimorphic species.

Sixth.—*Primula verticillata* is the last species which I have to notice as presenting the non-dimorphic structure. In wild and cultivated specimens I find exactly similar relations between the anthers and stigmas—the former attached to the upper third of the corolla-tube, and included, usually closely appressed to the stigma. I may state, however, that the length of the style is slightly variable (an occurrence which gives it a theoretical interest from its intimate affinity with the *P. floribunda* already noticed as a "*dimorphic*" species occasionally presenting individuals with a non-dimorphic structure); and though, as I have just stated, the stigma usually stands at an equal height with the anthers, it occasionally rises above them, or even becomes slightly exserted beyond the mouth of the corolla-tube.

These five species, then, with the variety of *Primula Sibirica* ?, are non-dimorphic so far as structure is concerned: in respect to their functional performances, I will here merely remark that, from my experience, two of the above species, viz. *P. mollis* and *Scotica*, seem to be perfectly self-fertile; in respect to a third, *P. verticillata*, this is very doubtfully the case, as the experiments which I will give in a subsequent part of my paper will show. In the genus *Primula*, then, as in that of *Linum* already illustrated by Mr. Darwin, we have species structurally and functionally hermaphrodite, as well as species which, though hermaphrodite as to structure, have undergone such differentiations in their male and female sexual elements as to render their mutual functional action so highly imperfect, that they have been aptly designated "*subdiœcious hermaphrodites*." How the former of these, the "non-dimorphic," should have escaped the notice of such excellent observers as Koch and Tausch, I fail to understand; but I feel convinced that a careful re-examination of the species will certainly induce them to cancel the above statement, if indeed the evidence which I have already adduced and that which I have yet to lay before the Society is not sufficiently demonstrative.

3. *Gregoria* presents at least one structurally "dimorphic" species, *G. Vitaliana*: respecting the others I am in perfect ignorance, never having seen specimens. In the "stort-styled" form of *G. Vitaliana* the anthers reach the mouth of the corolla-tube, while the pistil is about half the length of the latter. In the "long-styled" plants the anthers are attached about one-third below the mouth of the corolla-tube, the pistil in this case being exserted beyond the latter and fully twice as long as in the "short-styled" form. The pollen-grains in both forms are very similar—of an ovoid or oblong shape: the stigmas likewise are nearly of the same shape in both forms, apparently rougher in the "long-styled"; but I cannot speak confidently as to this, having only had dried specimens of the latter form to judge from. In respect to the reciprocal functional relations of these forms, I have no knowledge; but I think the following experiments on the "short-styled" form fully justify us in predicating the existence of a functional dimorphism. Three plants on which I had an opportunity of experimenting produced in the course of the season twenty-one flowers, which I treated in the following manner: five were left to natural agencies; eight were fertilized with own pollen; the remainder (eight) were fertilized with pollen from one of the other plants. The results were the complete abortion of every capsule of the two former, while in the latter case two cap-

sules were produced, but these did not contain a single good seed. I may also state that, after inquiring of various cultivators of alpine plants, I cannot hear that this plant ever produces seed. In Primulas, Mr. Darwin has shown that the pollen of the "short-styled" form, relatively to its own stigma, is considerably more sterile than the "long-styled" by its own-form pollen: may we not, then, in the "short-styled" forms of *Gregoria Vitaliana* have analogous relations of the sexual elements? Anyhow, the above experiments render it highly probable that for the production of perfect fertility the conjunction of the two forms is absolutely necessary.

4. The genus *Cortusa* is remarkable, though not peculiarly so, in apparently presenting the structure of the "long-styled" form only. I have at least failed in discovering the other form after a careful examination of the fine suite of specimens contained in the Edinburgh University Herbarium, as well as those in a few private herbaria. I find it to be the case also with cultivated plants of the *C. Matthioli*, the only representative of the genus; and in the generic definition by Linnæus "*stylus filiformis, exsertus*" also occurs, so that it is highly probable that the one form only exists. I will now briefly describe the floral structure of the genus in so far as connected with the economy of fertilization. The corolla-tube is short, with the limb expanding upwards in a campanulate manner; the filaments short, scarcely half the length of the obcordately-acuminated, excurrent anthers; the style is nearly three times the length of the stamens, and projects beyond the corolla. A plant which I protected from insects, when in flower, did not produce a single seed: those, on the other hand, which I artificially fertilized were perfectly fertile. I may further state, from the experience of others, as well as my own, that the plants of this species cultivated in our gardens, and left to the casual agencies of nature, produce in general a very small quantity of seed,—a consequence, perhaps, of their being less attractive to insects under cultivation than in their native haunts; for, undoubtedly, perfect fertilization can only be effected by some such agencies.

5. I have already stated that the structural relations of the sexual organs in *Cortusa* are not peculiar to it. In the allied genera *Dodecatheon* and *Soldanella* very similar relations are exhibited between the anthers and stigmas, the latter projecting considerably, in the majority of the species, beyond the former,—an occurrence which, considering the systematic affinities of the three

genera, favours the opinion that *Cortusa* has the structure of the one form only. *Dodecatheon* and *Soldanella* are also perfectly fertile when artificially fertilized: neither, however, in general, produce much seed in our gardens when fertilization is left to the agencies of nature. *Dodecatheon* is particularly deceptive in this respect, and ofttimes dupes the inexperienced collector of its seeds in our gardens by producing a profusion of well-formed and apparently good capsules destitute of all but the merest rudiments of seeds. In passing, I may remark that these genera (*Cortusa*, *Dodecatheon*, and *Soldanella*) afford excellent illustrations of a fact particularly emphasized by Mr. Darwin (*vide* Linn. Journ. vol. vii. p. 77), viz., that the fertilization of plants is not indifferently dependent on the agencies of insects or the action of the wind, inasmuch as they show that in the absence of the insects which visit them in their native habitats, or their non-attractiveness to those which frequent their new habitats, the mere action of the wind effects little in the economy of their fertilization.

6. The other genera of the Primulaceæ which I have had an opportunity of examining have stamens and pistils of an equal length, though occasional specific exceptions are certainly found. The *Lysimachia nutans* (a species referred to the genus *Lubinia* by Link and Otto) I would more particularly refer to in illustration of this, and, indeed, as possibly presenting both forms. In the single specimen which I have examined, the pistil was included within the tube of the corolla; the stamens *exserted* fully one-third beyond the latter! This relative inequality in the length of stamens and pistils is remarkable in a twofold manner—first, on considering the very general if not universal equality of the length of these organs in the other species of the genus, and secondly, from the circumstance that in this instance the *stamens* are the projecting organs; whereas in all the other representatives of the order (which I have examined) exhibiting differences in the length of stamens and pistils, I have invariably found that the latter organ was the more projected—excepting of course the genus *Primula*, though I strongly suspect that here all the dimorphic species are reciprocally so.

I have now briefly noticed those genera of Primulaceæ in which dimorphism has been observed—*Hottonia*, *Primula*, and *Gregoria*. These, singularly enough, are arranged by authors in the foregoing sequence from recognized structural relations—are thus seen to have innate bonds of affinity as manifested by those remarkable functional relations of the male and female sexual elements,—coincidences certainly not without an interest from a theoretical point of view. I have also noticed a few other genera, which, though not reciprocally dimorphic in structure, nevertheless present such relative inequalities in the length of their stamens and pistils, that certain external agents are absolutely necessary to induce anything like perfect fertility. In this arrangement of the sexual organs, then, it is evident that a better chance is afforded for the crossing of individuals than is the case in that arrangement where an equality in the length of the latter organs is observed. Thus nature presents us, as it were, with one of her simplest plans for effecting what Mr. Darwin on a thoroughly philosophical basis regards as one of the great ends gained by that more complex and novel plan in which she so differentiates the sexual elements of individual hermaphrodites, that the conjunction of these from distinct individuals is rendered imperative for the accomplishment of perfect fertility. In respect to the other genera of the order which I have examined, I observed nothing in the structural relations of the sexual organs worthy of special notice; this, however, is exclusive of the following genera, of which I know nothing—*Lubinia, Apochoris, Pelletiera, Asterolinum, Euparea*, and *Micropyxis*.

I will now give in detail my observations and experiments on several "*dimorphic*" and "*non-dimorphic*" species of *Primula*. The former of these, as previously stated, has been specially treated by Mr. Darwin, who, as might be expected, has left little for subsequent elucidation. This, indeed, is so much the case, that I fear my observations will do little more than show that the dimorphism manifested by those species to which Mr. Darwin's observations were directed is common to many more. It is, therefore, with no pretensions to originality that I venture to lay the following observations before this Society. However, as the phenomena of reciprocal dimorphism is comparatively new to science, further elucidations of it will not, I trust, be deemed superfluous.

*Primula Auricula*.—The dimorphic structure of this species has been fully described by Mr. Darwin, and we might anticipate, from the results of the few experiments he has made on this species, a functional dimorphism similar to that he has so ably illustrated in *Primula vulgaris, veris*, and *Sinensis*. I therefore had no intention of giving in detail the results of my experiments on the unions of the two forms of this species. My attention, however, has been lately directed to a tacit implication of the absolute sterility of the long-styled form. As this view is certainly erroneous, I will give, for the satisfaction of those who have had no means of testing the point at issue, the results of my own experience. The following are the results from plants growing together in a bed and freely exposed to the visits of insects*.

| | Number of plants. | Number of umbels produced. | Number of capsules produced. | Number of seeds produced. | Number of umbels. | Number of seeds. |
|---|---|---|---|---|---|---|
| Short-styled Auriculas...... | 10 | 33 | 287 | 2734 | 50 | 4142 |
| Long-styled Auriculas...... | 10 | 41 | 323 | 1816 | 50 | 2215 |

Again, in the following table the results are given from plants carefully protected from insects; though in no way effecting their fertility, as I proved by artificial fertilization.

| | Number of plants. | Number of umbels produced. | Number of flowers produced. | Number of seeds produced. |
|---|---|---|---|---|
| Short-styled Auriculas...... | 6 | 26 | 263 | 104 |
| Long-styled Auriculas...... | 6 | 22 | 272 | 8 |

If we compare the seed-results in the former of the above tables, we see that the short-styled are the more fertile—exceeding the long-styled in about the proportion of two to one. Again, in the latter table we see that the short-styled forms are also the more productive, though, comparatively with the results from the exposed plants, extremely sterile, showing us clearly how much these plants are dependent for their fertilization on insects or other mechanical agencies. This is more especially the case in the long-styled plants whose stigma stands high above the stamens, so that pollen cannot possibly reach the stigma without mechanical aid. The seed-results of this form in my table were the product of a single umbel infested with aphides; and which I have no doubt were the fertilizing agents, as not a single seed was produced upon any of the others. In the case of the short-styled plants, on the other hand, a low degree of fertility may be pretty regularly effected: the stamens surrounding the mouth of the corolla-tube are more or less inclined inwards, so that the anthers lie over though high above the nearly sessile stigma, thus affording a great facility for the pollen falling upon it. Indeed, but for the coherent nature of the pollen-grains, which do not readily fall from the anthers, these short-styled Auriculas would very regularly yield an amount of seed equal to an ordinary homomorphic union.

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* This and the succeeding Tables are arranged after the manner of Mr. Darwin (*loc. cit.*). It will be observed, however, that instead of giving the weight of the seeds, as he has done, I have given their number. This alteration has been made at the suggestion of Mr. Darwin, who considers that greater exactitude is thereby attained.

I may here notice a fact with which I have only lately become acquainted, though I understand it has been long known to cultivators of the Auricula, viz. that if "alpine" Auriculas* are grown amongst other varieties, the seeds saved from the latter produce plants the majority of which present the characteristics of the "alpine" variety. So that the pollen of this variety apparently exercises a prepotent influence over that of the other varieties, as shown by its superior power of impressing likeness on the offspring. It would be interesting to know if the female element possesses a like prepotency in transmitting likeness when treated with the pollen of the others, or whether, as is more frequently the case in the crossing of species, this power runs more strongly in the one sex than in the other. Irrespective of this, however, we see—and the fact is highly interesting from its bearings on one of the alleged physiological differences between species and varieties—that varieties like species when crossed have occasionally an individual prepotency in transmitting likeness. To recur to our more immediate subject: in ignorance of the above knowledge respecting the dispersion of the pollen of "alpine" Auriculas, I was much surprised at the great fertility of a somewhat isolated long-styled "self"-Auricula†, the nearest to it being a short-styled "alpine" variety about four yards distant. The former of these plants produced a single umbel, every capsule of which was full of seed; and thus presented a marked contrast with the results I had previously got from long- and short-styled plants growing together in a bed. I have now no doubt, though I have not proved it by sowing the seed, that the increased fertility of the above plant was due to fertilization by pollen of the neighbouring "alpine" plant.

In the following table I have given the results of several artificial "homomorphic" and "heteromorphic unions" of yellow-flowered varieties of *Primula Auricula* approaching closely the normal form of the species.

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* A term applied by florists to those varieties of Auricula which have that portion of the flower immediately around the stamens of a yellow, and that exterior to this of different colours.

† The term "self" is applied by the florist to those varieties which have a circle of white surrounding the stamens, exterior to which is a broad single coloured border.

TABLE I.—*Primula Auricula.*

| | Number of flowers fertilized. | Number of capsules produced. | Number of seeds produced. |
|---|---|---|---|
| Long-styled by own-form pollen (homomorphic union) | 16 | 13 | 153 |
| Long-styled by pollen of short-styled (heteromorphic union) ........................................ | 18 | 17 | 1245 |
| Short-styled by own-form pollen (homomorphic union) | 16 | 12 | 169 |
| Short-styled by pollen of long-styled (heteromorphic union)........................................ | 18 | 18 | 1764 |
| SUMMARY. | | | |
| The two homomorphic unions ............................ | 32 | 25 | 322 |
| The two heteromorphic unions ............................ | 36 | 35 | 3009 |

By reducing the figures of the two homomorphic and the two heteromorphic unions, we get the following proportions:—

| | Number of flowers fertilized. | Good capsules produced. | Number of seeds produced. | Good capsules. | Seeds. |
|---|---|---|---|---|---|
| The two homomorphic unions...... | 100 | 78 | 1004 | 100 | 1288 |
| The two heteromorphic unions ... | 100 | 97 | 8339 | 100 | 8597 |

This comparative tabulation of the different unions shows that the flowers of the two heteromorphic unions produce a greater number of good capsules and seeds than the flowers of the two homomorphic unions. The good capsules of the two heteromorphic unions yield more seed, in about the proportion of seven to one, than those from the two homomorphic unions! Again, if we refer to the different unions of the two forms given separately in the upper table, we see that the short-styled forms produce the most seed in both homomorphic and heteromorphic unions. Thus, taking the two homomorphic unions, we see that the average of seeds per capsule from the short-styled unions is fourteen, that from the long-styled unions scarcely twelve, or as seven to six. In the heteromorphic unions these proportions are increased, the short-styled forms averaging 98, the long-styled 73 seeds per capsule,—that is, nearly as eight to six. These results, though clearly showing that the short-styled unions in every case yield the greatest amount of seed, are nevertheless far from lending any support to the opinion which I have already alluded to, *i. e.* the absolute sterility of the long-styled unions. This view seems to be entertained by Professor Treviranus, who states (Bot. Zeit. 1863, p. 6) that he found a plant of the long-styled *Primula Auricula* growing near a short-styled form, yet not one of the numerous flowers of the former produced a seed-capsule. We now know the absolute necessity for insect-agency in the fertilization of the long-styled form; hence, as I think, the observation of Professor Treviranus simply permits the inference that no insects had visited the plant. As all my results, however, have been obtained from less or more modified varieties of the *Primula Auricula*, whereas the observation of Professor Treviranus may possibly refer to the normal form of the species, objections may thence be taken to my regarding the former as correctly indicating the possible results of the latter. In view of such an objection, I can only add, that I have never had an opportunity of performing a single experiment on either form of the normal *P. Auricula*; but I can aver, from the examination of native specimens in herbaria, that the long-styled form *does produce capsules containing good seeds.*

As bearing upon this point, however, I may state that I never succeeded in getting a single good seed from homomorphic unions of the long-styled form of *Primula denticulata*[*]. I had also a few flowers sent of the short-styled form of this species, with which I fertilized a single umbel of the former; but in this case also, though a few capsules swelled, every seed was abortive. I do not, however, wish to be understood as positively inculcating the absolute sterility of this form; though, certainly, I can assign good reasons for so regarding cultivated plants under *homomorphic* treatment. Thus, in the Royal Botanic Gardens of Edinburgh there are at present a few dozens of plants of the *P. denticulata*, consisting exclusively of the long-styled form. Mr. M'Nab informs me that a varying number of these have been cultivated in the Gardens for upwards of eighteen years, yet, though affording annually a profusion of flowers, he has never known them to produce a single seed. This evidence is of course open to the objection that sterility in this case (as in that previously noticed) may be due to the absence of insects; but it is to be remembered that we have here, as already stated, experimental observations affording similar evidence. These, conjointly with the long-continued observations of Mr. M'Nab, fully justify our suspicions respecting the sterility of the long-styled form under cultivation. The phenomena of sterility, however, are truly so capricious, that but for the remarkable sexual relations of the dimorphic species of *Primula* (including, as some suppose, a possible tendency to the diœcious structure), such observations were entirely superfluous; and this the more especially, as I am now aware, from observations on native specimens in the Edinburgh University Herbarium, that the long-styled forms do produce seed. Those who believe that dimorphism is a step towards diœciousness, instead of attributing sterility in the present case to certain unnatural conditions, will naturally be inclined to suppose that by man's artificial treatment the development of the plan of nature has been accelerated, the phenomena of reciprocal dimorphism exhausted by the functional impotence of the female element of the hypothetical male, and the final step made to the complete separation of the sexes.

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[*] This species presents the two forms; their long salver-shaped corollas exhibiting very marked differences from the positional changes in the attachment of the anthers. These are accompanied with other differences: the pistil in the long-styled form is fully four times as long as that of the short-styled; the stigma is also twice as long, and rougher; the pollen-grains smaller, but of a similar triangular shape in both forms.

I have hitherto spoken of two forms only of the *Primula Auricula*, viz. the long- and short-styled; occasionally, however, in this as in other truly dimorphic species, a third form occurs with stamens and pistils of an equal length. This trifling structural difference of the latter is connected with very important functional differences, as we find it yields much more seed when self-fertilized than either homomorphic union. In the following table I will illustrate this by giving the results from a self-fertilized umbel of an equal-stamened and -styled form; besides these, I have also given the results from unions between the latter and the long- and short-styled forms.

TABLE II.—*Primula Auricula*.

| | Flowers fertilized. | Number of capsules. | Number of seeds. |
|---|---|---|---|
| Equal-stamened and -styled form by own pollen ......... | 14 | 9 | 272 |
| Short-styled union—pollen from the above ............... | 12 | 7 | 59 |
| Long-styled union—pollen from the above ............... | 12 | 9 | 47 |

The sexual powers of this equal-stamened and -styled form have a twofold interest: first, when viewed comparatively with the pure homomorphic unions of the other forms; and secondly, when the mutual sexual relations existing between it and the latter are taken into consideration. For the sake of illustrating these important points we will enter into a few comparative details. First, then, if we compare the results given in Table II. from the equal-stamened and -styled form when self-fertilized, with the most fertile of the homomorphic unions given in Table I., we see that the former produces more seed than the latter, the proportions being fully as two to one. Secondly, the results in Table II., from the short-styled form by the application of pollen from the form with stamens and styles of an equal length, afford an average of eight seeds per capsule, which is six seeds per capsule below the average homomorphic union of this form. Again, from the union of the long-styled form with the equal-stamened and -styled form, the average is reduced to five seeds per capsule, which is seven below the average produce of this form's homomorphic union. The lowest average of seeds is thus seen to be produced by the union of the equal-stamened and -styled with the long-styled form. This result I had partly anticipated from observations on the pollen-grains of the equal-stamened and -styled form, as I found that they agreed very closely with those characteristic of the long-styled form, and decidedly less than those of the short-styled form. From these results and observations, then, we may justifiably conclude, as Mr. Darwin has done from observations on a similar form (*loc. cit.* p. 80), that the equality in the length of the stamens and pistils was due to an abnormal development of the stamens, as shown by the relatively small grains of pollen they produced. We are thus afforded a tolerably satisfactory explanation for the decreased fertility remarked upon above, between the unions of this form and the long- and short-styled forms, in comparison with the homomorphic unions of the latter. There is yet, however, a most interesting fact, for which I can offer no explanation, namely, the high relative fertility of the equal-stamened and -styled form when fertilized with own pollen. We have seen that this form differs structurally from the long-styled form only in the place of attachment of the anthers, agreeing with it in the more important characteristics of the size of pollen-grains and stigma: physiologically, however, there is a marked divergence—an important functional adaptation in the relation of its own pollen to its own stigma.

No one has hitherto tested the influence of *dimorphism* on *hybridism*; and now, having done with the individual and reciprocal relations of the sexual powers in the different forms of *Pri-*

*mula Auricula*, I will, by way of illustrating the above phenomena, give the results of several experiments on the hybridization of *P. Auricula*. These are as follows:—

Table III.—Hybrid unions of *Primula Auricula*.

| | Number of flowers fertilized. | Total number of capsules produced. | Number of good capsules. | Number of seeds produced. | Average number of seeds per capsule. |
|---|---|---|---|---|---|
| *Primula Pallinurii*, long-styled, by pollen of long-styled *P. Auricula** | 6 | 4 | 4 | 265 | 66 |
| *P. Auricula*, short-styled, by pollen of short-styled *P. viscosa* | 8 | 4 | 2 | 165 | 82 |
| *P. Auricula*, long-styled, by pollen of short-styled *P. hirsuta* | 8 | 4 | 3 | 168 | 56 |
| *P. Auricula*, short-styled, by pollen of short-styled *P. hirsuta* | 8 | 3 | 2 | 84 | 42 |
| *P. Auricula*, long-styled, by pollen of the non-dimorphic *P. verticillata* | 10 | 7 | 4 | 59 | 15 |

For the clear appreciation of the degree of sterility of the union of distinct species with the *P. Auricula*, relatively to the lessened fertility of the pure homomorphic unions as compared with the pure heteromorphic unions of the latter, I have made the following comparative tabulation (see Table IV. p. 94) of the results given in the Table of the hybrid unions, with those from the summary of the different unions of *P. Auricula* in Table I.:—

In the second column of the table, the calculated number of seeds is given of the hybrid unions of *P. Auricula* relatively to the hundred seeds produced by the pure heteromorphic unions of that species given in the first column. The fourth column contains a similar estimate of number of seeds by the homomorphic unions of *P. Auricula* relatively to the hundred by the hybrid unions given in the third column. If we compare the results, we see that the decreased fertility of the homomorphic unions relatively to the heteromorphic unions in *P. Auricula* exceeds more or less that of each of the four hybrid unions of that species. These are most formidable facts for those who look upon sterility as a special endowment to prevent the blending of organic forms. Utterly irreconcileable, indeed, with such an idea, they, on the other hand, plainly show "that sterility is not a specially acquired or endowed quality, but is incidental on other acquired and little-known differences," as Mr. Darwin has very properly urged.

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* The scape of *Primula Pallinurii* met with an injury which prevented the perfect maturing of the seeds; nevertheless, from an examination of a number of them, I believe the above is a fair estimate of the good embryonated seeds. I may here state, as worthy a passing notice, that while the above long-styled plant of *P. Pallinurii* produced both a large percentage of good capsules and seeds when fertilized by pollen of *P. Auricula*, every capsule aborted of twenty-two flowers fertilized by own pollen, though the pollen-tubes freely penetrated the stigmatic tissue. We thus see—and the fact is most interesting—that while the female element of a long-styled *Primula* has become impotent to its own male element, it is yet susceptible of fertilization by the male element of a distinct species.

TABLE IV.—Pure and hybrid unions of *P. Auricula.*

| | Number of seeds produced by the heteromorphic unions of *P. Auricula.* | Number of seeds produced by the hybrid unions of *P. Auricula.* | Number of seeds produced by the hybrid unions of *P. Auricula.* | Number of seeds produced by the homomorphic unions of *P. Auricula.* |
|---|---|---|---|---|
| The heteromorphic unions relatively to the homomorphic unions of *P. Auricula* | 100 | ... | ... | 15 |
| The short-styled homomorphic union of *P. Auricula* by pollen of *P. viscosa* relatively to the pure unions of the former | 100 | 96 | 100 | 16 |
| The long-styled heteromorphic union of *P. Auricula* by pollen of *P. hirsuta* relatively to the pure unions of the former | 100 | 65 | 100 | 23 |
| The short-styled homomorphic union of *P. Auricula* by pollen of *P. hirsuta* relatively to the pure unions of the former | 100 | 49 | 100 | 31 |
| The union of long-styled *P. Auricula* by pollen of the non-dimorphic *P. verticillata* relatively to the pure unions of the former .................................. | 100 | 17 | 100 | 87 |

In Table III. I have given the results of all my *successful* experiments on the hybridization of *Primula Auricula*: it is necessary, however, for the more complete elucidation of the influence of dimorphism on hybridism, that I also subjoin a few instances of my unsuccessful trials, in so far as connected with the reciprocal unions of those already given. First, then, by referring to Table IV. we see that the short-styled homomorphic unions of *P. Auricula* by pollen of *P. viscosa* are highly fertile; nevertheless I have completely failed to fertilize reciprocally *P. viscosa* by pollen of *P. Auricula.* I also failed to effect an heteromorphic union between these species: my experiments, however, in this case were limited to the long-styled *P. Auricula* by pollen of short-styled *P. viscosa.* Again, secondly, the long-styled heteromorphic and short-styled homomorphic unions of *P. Auricula* by pollen of *P.*

*hirsuta* are given in the table; but I have failed by either form pollen to effect the converse unions, *i. e.* fertilize the short-styled *P. hirsuta* by either form pollen of the *P. Auricula*. In the case of the long-styled form of *P. hirsuta* I utterly failed to effect a single union, though I tried it homomorphically and heteromorphically by the two-form pollens of *P. Auricula*, and also conversely by applying the pollen of the long-styled *P. hirsuta* to the two forms of *P. Auricula**. These few details then will enable us to consider, in part, the amount of parallelism existing between certain of the phenomena of hybridism in normal hermaphrodite species, and the hybridism of dimorphic species. In the fertilization of hermaphrodite species, several cases occur in which the male element of the one, A, for example, fertilizes the female element of the other, B, while the male element of B will not fertilize the female element of A: so in the hybridism of dimorphic species, with the important appanage of an increased complication of the conjunctive powers, we find analogous cases. Thus, let A *l* and A *s* and B *l* and B *s* respectively represent the long- and short-styled forms of the *P. Auricula* and *P. hirsuta* given above, then while the male element of A *s* fertilizes the respective female elements of B *l* and B *s*, that of A *l* cannot fertilize either of the latter; again, there is a mutual impotence between the male elements of B *l* and B *s* and the female elements of A *l* and A *s*. We thus see that a close parallelism exists between those remarkable phenomena occasionally observed in the reciprocal crossing of species on the one hand, and those observed in the reciprocal crossing of the two sexual individuals of a dimorphic species with those of a distinct dimorphic species on the other. In the latter case, as compared with the former, there is of course a greater complexity in the functional relations—eight crosses being possible between dimorphic species,—and so it is with the results, which are certainly most astounding; inasmuch as each of the sexual forms of a species manifest in their respective powers for conjunctions with those of another species, physiological peculiarities which might well entitle them, by the criterion of fertility, to specific distinction.

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* It may be advisable to state the number of flowers fertilized in each of the subjoined experiments:—First series, *P. Auricula* and *P. viscosa*: I fertilized eight flowers of the short-styled *P. viscosa* by pollen of the short-styled *P. Auricula*, and ten flowers of the long-styled *P. Auricula* by pollen of the short-styled *P. viscosa*. Second series, *P. Auricula* and *P. hirsuta*: of sixteen flowers of the short-styled *P. hirsuta*, one-half were fertilized by pollen of the long-styled, and the other by that of the short-styled *P. Auricula*; again, of the long-styled *P. hirsuta*, five flowers were fertilized by pollen of the long-styled, and five by that of the short-styled *P. Auricula*; in the converse unions of these, ten long-styled and ten short-styled flowers of the *P. Auricula* were fertilized by pollen of the long-styled *P. hirsuta*. Thus, including the three successful unions of these species given in Table III., we find that the above phenomena are the results of eighty-eight flowers, in each case carefully fertilized.

There is another interesting point illustrated by the above experiments upon which I will venture a few remarks—subject to the reservation, however, of their being modified by more numerous experiments. It is now perfectly well known that the two forms of several species of Primulas have their sexual powers so correlated, that while very imperfect fertility results from the fertilization of either form by own-pollen (a homomorphic union), perfect fertility results from the application of the pollen of the one form to the stigma of the other (a heteromorphic union). In the present instance, then, we are naturally led to inquire whether these correlations of the sexual powers in the two forms of a species extend in parallel lines to the two forms of a distinct species when hybridized? or are they limited in their operation to the individual forms of the species? In other words, in the hybridizing of dimorphic species, is the heteromorphic definitely more fertile than the homomorphic union? or is the alternative innately variable? Let us again, for a moment, recur to the above details and Table of hybrid unions for a little enlightenment on these queries. First, we see the short-styled *homomorphic union* of *P. Auricula* by pollen of *P. viscosa, highly fertile*; while of the other three unions tried between these species (*two heteromorphic* and *one homomorphic*), not one flower produced a seed-capsule! Again, secondly, successful results are derived from the long-styled *heteromorphic* and the short-styled *homomorphic* unions of *P. Auricula* by pollen of *P. hirsuta*,—the *heteromorphic* yielding more seed than the *homomorphic* in the proportion of 4 to 3. The other possible unions of these forms (three *heteromorphic* and three *homomorphic*) were also tried; but they did not produce a *single seed-capsule*! What now do these several experiments teach us respecting the points at issue? Looking to the successful experiments alone, we might be inclined to suppose, from the result of *P. Auricula* and *P. hirsuta*, that in the hybrid unions, as well as in the cross-unions of the two forms of a species, the *heteromorphic* were the more fertile,—even with the *remarkable fertility* of the *short-styled homomorphic unions* of *P. Auricula* and *P. viscosa* staring us in the face. On the other hand, if we take a general view of the evidence, and carefully balance and reflect on the results, I think we are all but forced to conclude that the parallelism noticed above is accidental*, and that, even as the greatest capricity and uncertainty is manifested in the sexual conjunctions of the respective forms, so is there a like capricity and uncertainty in the degree of fertility thereby induced. In fine, as there is a general indefiniteness in the results of the reciprocal unions of normal hermaphrodite species, so I believe (as above indicated) we shall find similar irregularities in the results of the reciprocal unions of the two forms of dimorphic species.

*Primula vulgaris* and the var. *alba* present both forms; of the *P. vulgaris*, var. *rubra*, I have seen the long-styled form alone. I instituted a series of experiments on these forms, with the view of determining the results of their reciprocal unions. Certain of these are so remarkable, that I hesitate not a little in bringing them forward until I have had again an opportunity of repeating my experiments. From their bearings, however, on certain highly important points in theoretical natural science, I will (subject to the above reservation) venture to lay the results before the Society, and thus directing the attention of those interested in such phenomena to subjects well worthy a careful experimental examination, show also that my results, remarkable though they undoubtedly are, have a basis sufficiently extensive to justify me in regarding them as at least an approximation to the true functional relations of these plants.

In the following Table I have given the results of my experiments on several plants of the above varieties, growing in pots and subjected to exactly similar treatment:—

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* The necessity for further experimentation on this point, however, is shown by the following cases mentioned by Mr. Darwin, 'Origin of Species,' 3rd edit. p. 293, on the authority of Gärtner: "namely, that yellow and white varieties of the same species of *Verbascum* when intercrossed produce less seed than do either coloured varieties when fertilized with pollen from their own coloured flowers." Again, "that when yellow and white varieties of one species are crossed with yellow and white varieties of a DISTINCT species, more seed is produced by the crosses between the similarly coloured flowers than between those which are differently coloured." We thus see that the functional relations of varieties of a species MAY extend to, and similarly correlate the varieties of DISTINCT species!

TABLE V.—*Primula vulgaris*, and vars. *alba* and *rubra*.

| | Number of flowers fertilized. | Total number of capsules produced. | Total number of good capsules produced. | Number of seeds produced. | Average number of seeds per capsule. |
|---|---|---|---|---|---|
| *Primula vulgaris*, var. *alba*, short-styled unions:— | | | | | |
| Homomorphic unions | 14 | 10 | 8 | 106 | 13 |
| Heteromorphic unions | 12 | 10 | 10 | 206 | 21 |
| *Primula vulgaris*, var. *alba*, long-styled unions:— | | | | | |
| Homomorphic unions | 10 | 8 | 5 | 56 | 11 |
| Heteromorphic unions | 10 | 9 | 8 | 155 | 19 |
| *Primula vulgaris*, var. *alba*, by pollen of *P. vulgaris*, short-styled unions:— | | | | | |
| Homomorphic unions | 10 | 8 | 6 | 27 | 4 |
| Heteromorphic unions | 10 | 7 | 7 | 103 | 14 |
| *Primula vulgaris*, var. *alba*, by pollen of *P. vulgaris*, long-styled unions:— | | | | | |
| Homomorphic unions | 8 | 6 | 5 | 24 | 5 |
| Heteromorphic unions | 8 | 6 | 6 | 112 | 17 |
| *Primula vulgaris*, by pollen of *P. vulgaris*, var. *alba*, short-styled unions:— | | | | | |
| Homomorphic unions | 10 | 8 | 7 | 35 | 5 |
| Heteromorphic unions | 10 | 7 | 7 | 116 | 17 |
| *Primula vulgaris*, by pollen of *P. vulgaris*, var. *alba*, long-styled unions:— | | | | | |
| Homomorphic unions | 10 | 8 | 6 | 28 | 5 |
| Heteromorphic unions | 10 | 9 | 8 | 150 | 19 |
| *Primula vulgaris*, var. *rubra*, long-styled union:— | | | | | |
| Homomorphic union | 14 | 11 | 11 | 159 | 14 |
| *Primula vulgaris*, var. *rubra*, long-styled, by pollen of *P. vulgaris*:— | | | | | |
| Homomorphic union | 12 | 0 | | | |
| Heteromorphic union | 12 | 0 | | | |
| *Primula vulgaris*, var. *rubra*, long-styled, by pollen of *P. vulgaris*:— | | | | | |
| Homomorphic union | 8 | 0 | | | |
| Heteromorphic union | 8 | 0 | | | |

It may perhaps be desirable that the Society should have a detailed account of my experiments on effecting unions between the *P. vulgaris*, var. *rubra*, and the others, viz. *P. vulgaris*, and var. *alba*. As in that above given, the remarkable results are alone stated—the absolute zero of fertility, apparently, attained between undoubted varieties of a species![*] By way of a preliminary to the special account of experiments, it is necessary to state that the red Primrose rarely ever, in its own natural state, produces a single seed—a peculiarity possessed in common with the abovementioned white variety. Both of these varieties, Mr. M'Nab informs me, have been cultivated in the Botanic Gardens of Edinburgh for a number of years; yet, previous to this season, he has not known them to produce a single seed. With the view of satisfying myself as to the absolute sterility of these plants, I instituted a series of experiments, the results of which show that this is only partly correct,—certain individuals being perfectly fertile, others absolutely sterile, pollen being carefully applied to both. This is shown by the following experiments:—First, I selected a few fine vigorous-growing plants of the red and white varieties, and continued for some time regularly fertilizing the flowers as they were successively developed. I feel certain that I thus fertilized upwards of two hundred flowers without getting a single seed! Secondly, I directed my experiments to those plants which, with a less vigorous habit, produced a greater profusion of blooms. These I found to be alone productive—at least when artificially fertilized—for they seem to be equally as sterile as the others when fertilization is left to natural agencies: perhaps they are less sought after by insects than the common yellow Primrose. Anyhow, I have failed to detect a single seed on those plants in the Botanic Gardens of Edinburgh, which had proved fertile by artificial treatment, on leaving them to the agencies of nature. Those plants of the red and white Primrose, stated in the above table to yield such remarkable results, were also proved *susceptible* of *artificial fertilization* with *own pollen, both before and after I had repeatedly failed in effecting good results from cross-unions between them*, and also between *them* and the *common Primrose: every capsule thus treated*, singularly enough, *proved abortive*! However these results then may be modified by future experimentation, the following important conclusion will remain unaffected, namely, that plants of the *P. vulgaris*, var. *rubra*, characterized, as we have already shown, by the most capricious and uncertain performance of their sexual functions, nevertheless *proved fertile when treated with own pollen*; AT THE SAME TIME that *similar ex-*

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[*] The pure descent of the red and white Primrose from the common yellow has been questioned, and a hybrid origin from the Cowslip and Primrose (*P. veris* and *P. vulgaris*) ascribed to them. To my mind, the latter view is negatived by the results given in the above table. It is there shown that both (red and white) forms are, relatively to the results of similar unions with the common

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Primrose, perfectly fertile *inter se*; whereas by their unions with the latter we see in the one case a relatively decreased fertility, in the other absolute sterility resulting! How utterly inconsistent, then, are such results with the idea of hybridity! In consonance with a hybrid origin, an increased instead of a decreased fertility ought to have resulted from the latter unions.

*perimentations* upon them with the *pollen* of the *parental form* (*P. vulgaris*), and likewise *that* of the other *modified descendant* (*P. vulgaris*, var. *alba*) *resulted in the abortion of every seed*! Such then are the experimental data from which the remarkable results stated in the latter part of Table V. were derived. That they are not sufficiently numerous to demonstrate the *unconditional* existence of an absolute sterility between two modified descendants from a common parent, and also between the latter and one of the former, I have already admitted; nevertheless I think they clearly demonstrate the *conditional* existence of physiological divergences sufficient in extent to induce complete sterility. How, I ask, on any other grounds than by the admission of the conditional existence of such physiological divergences can we explain the phenomena in question,—namely, the existence of plants *perfectly fertile* when their flowers are *fertilized* by *own pollen*, and yet, at the same time, yielding naught but abortive results from those flowers fertilized by the pollen of the other variety and by that of their common parent?

I will now reduce, for the sake of comparison, the figures of the different unions given in Table V.; first of the long- and short-styled homomorphic unions, and second, of the long- and short-styled heteromorphic unions.

TABLE A.—*Primula vulgaris* and vars. *alba* and *rubra*.

| | Number of flowers fertilized. | Number of good capsules. | Number of seeds. | Number of good capsules. | Number of seeds. |
|---|---|---|---|---|---|
| LONG-STYLED HOMOMORPHIC UNIONS. | | | | | |
| *P. vulgaris*, var. *rubra*, by own-form pollen... | 100 | 78 | 1124 | 100 | 1445 |
| *P. vulgaris*, var. *alba*, by own-form pollen ... | 100 | 50 | 560 | 100 | 1120 |
| *P. vulgaris*, var. *alba*, by pollen of *P. vulgaris* | 100 | 62 | 297 | 100 | 480 |
| *P. vulgaris* by pollen of *P. vulgaris*, var. *alba* | 100 | 60 | 280 | 100 | 466 |
| SHORT-STYLED HOMOMORPHIC UNIONS. | | | | | |
| *P. vulgaris*, var. *alba*, by own-form pollen ... | 100 | 57 | 755 | 100 | 1325 |
| *P. vulgaris*, var. *alba*, by pollen of *P. vulgaris* | 100 | 60 | 270 | 100 | 450 |
| *P. vulgaris* by pollen of *P. vulgaris*, var. *alba*. | 100 | 70 | 350 | 100 | 500 |

TABLE B.—*Primula vulgaris* and var. *alba*.

| | | | | | |
|---|---|---|---|---|---|
| LONG-STYLED HETEROMORPHIC UNIONS. | | | | | |
| *P. vulgaris*, var. *alba*, by own-form pollen ... | 100 | 80 | 1550 | 100 | 1937 |
| *P. vulgaris*, var. *alba*, by pollen of *P. vulgaris* | 100 | 75 | 1400 | 100 | 1866 |
| *P. vulgaris* by pollen of *P. vulgaris*, var. *alba* | 100 | 80 | 1500 | 100 | 1875 |
| SHORT-STYLED HETEROMORPHIC UNIONS. | | | | | |
| *P. vulgaris*, var. *alba*, by own-form pollen ... | 100 | 83 | 1709 | 100 | 2060 |
| *P. vulgaris*, var. *alba*, by pollen of *P. vulgaris* | 100 | 70 | 1030 | 100 | 1471 |
| *P. vulgaris* by pollen of *P. vulgaris*, var. *alba* | 100 | 70 | 1160 | 100 | 1657 |

In the comparative tabulation of the long-styled homomorphic unions (Table A.), I have assumed, in the first column, that 100 flowers were fertilized, and in the two columns to the right of this, given the relatively increased proportions of capsules and seeds; again, the right-hand column gives the calculated results from an assumed 100 of good capsules. If we compare the results, we see, first, that the short-styled form of *P. vulgaris*, var. *alba*, yields more seed, in about the proportion of 13 to 11 seeds per capsule, than those of the long-styled form, while the long-styled *P. vulgaris*, var. *rubra*, again exceeds the former in about the proportion of 14 to 13 seeds per capsule. In the reciprocal homomorphic unions of *P. vulgaris* and the variety *alba* we see some little discordance in the results: thus, the most productive union is the short-styled homomorphic union of *P. vulgaris* by pollen of *P. vulgaris alba*, whereas the least productive of the four is the converse union of these forms. Again, in the long-styled homomorphic unions most is yielded from the unions of *P. vulgaris alba* by pollen of *P. vulgaris*; so that the *most fertile* of the *long-* and *short-styled crosses* are thus seen to *result from converse unions*, namely in the former case from *P. vulgaris alba* by pollen of *P. vulgaris*, in the latter from *P. vulgaris* by pollen of *P. vulgaris alba*!

In the comparative tabulation of the long-styled heteromorphic unions (Table B.) a similar arrangement is observed to that in Table A. The calculated results of these unions also show that the short-styled form of *P. vulgaris alba* when fertilized by own pollen is the more fertile, exceeding the similar long-styled union in the proportion of 20 to 19 seeds per capsule: compared with the short-styled *homomorphic* the proportions are as 20 to 13 seeds per capsule, or as 4 to 3 in favour of the long-styled *heteromorphic*. This relative accordance of the degrees of fertility resulting from similar homomorphic and heteromorphic unions when these are *treated* by *own pollen* does not extend itself to the *cross-unions* of the different forms, the relative degree of fertility of the similar homomorphic and heteromorphic *cross-unions* being very irregular. Thus, in Table B., the *long-styled heteromorphic cross* of *P. vulgaris* by pollen of *P. vulgaris alba* yields more seed than that of the *similar* short-styled heteromorphic cross, in nearly the proportion of 19 to 17 seeds per capsule. In the converse unions of these, the long-styled heteromorphic cross of *P. vulgaris alba* also exceeds the similar short-styled heteromorphic cross, in about the proportion of 19 to 15. Again, in Table A. we see the highest degree of fertility resulting from the converse union of that in Table B., namely the short-styled homomorphic cross of *P. vulgaris* by pollen of *P. vulgaris alba.* In the long-styled homomorphic as compared with the long-styled heteromorphic unions, the highest degree of fertility is also the result of the converse unions of *P. vulgaris* and *P. vulgaris alba*! This discordance in the results of the different crosses surprised me much, though perhaps, after all, I had no right to expect perfect accordance or definite results from the reciprocal unions of normal individuals of a species, which consequently had a long-acquired morphological *status*, and of those from incipient or unestablished forms.

There is another point in the above tables to which I wish particularly to draw attention, namely the decreased proportion of seeds resulting from the cross-unions of *P. vulgaris* and *P. vulgaris alba*, relatively to the pure unions of either form. Thus, if we look to the short-styled heteromorphic unions, we find the *P. vulgaris alba* yielding with its own pollen above 20 seeds per capsule, while with the pollen of *P. vulgaris* it scarcely yields 15 seeds per capsule—that is, nearly as 2 to 3! Again, in the corresponding table of the homomorphic unions we find these proportions increased,—namely, *P. vulgaris alba* by own pollen yielding about 11 seeds per capsule, and by pollen of the *P. vulgaris* about 5 seeds per capsule, thus giving the proportions of 2 to 1! Such results as these from plants presenting no other appreciable difference than that of colour well exposes the slippery foundation of that dogma of natural science which would have us believe that nature had specially endowed organic beings with sterility to prevent the blending of specific types. These illustrations of sterility, in conjunction with those remarkable revelations of dimorphism, in which the sexual organs of a hermaphrodite individual undergo such great differentiations with respect to their mutual action, might certainly suffice to show that sterility is not a special endowment, but a necessary result of secondary causes, which have no connexion whatever with special ends in the development of the classifying principle.

With my experiments in crossing *P. vulgaris* with *P. veris* I was most unfortunate; all my experimental plants met with an accident, and thus provokingly disappointed me of the results of my work. But for the kindness of Mr. Darwin, who, when I made him aware of my misfortune, obligingly sent me the following table, comprising the results of his experiments on the crossing of these species, I should have been entirely unable to illustrate this important part of my subject. With the exception, then, of the two first unions (the few results derived from my own experiments), all the others in the following table have been afforded me by Mr. Darwin.

TABLE VI.—Cross-unions of Primroses, Cowslips, and Polyanthuses.

| | Number of flowers fertilized. | Total number of capsules. | Number of seeds. | Average number of seeds per capsule. | By calculation. | |
|---|---|---|---|---|---|---|
| | | | | | Good capsules. | Number of seeds. |
| Long-styled Cowslip by pollen of Primrose: | | | | | | |
| Homomorphic union | 8 | 3 | 33 | 11 | 50 | 550 |
| Heteromorphic union | 8 | 0 | 0 | 0 | | |
| Long-styled Primrose by pollen of Cowslip: | | | | | | |
| Homomorphic union | 3 | 2 | 20 | 10 | 50 | 500 |
| Heteromorphic union | 3 | 0 | 0 | 0 | | |
| Long-styled Primrose by pollen of Polyanthus: | | | | | | |
| Homomorphic union | 5 | 0 | 0 | 0 | | |
| Heteromorphic union | 5 | 2 | 53 | 26 | 50 | 1325 |
| Short-styled Primrose by pollen of Cowslip: | | | | | | |
| Homomorphic union | 3 | 0 | 0 | 0 | | |
| Heteromorphic union | 3 | 3 | 142 | 47 | 50 | 2366 |
| Short-styled Primrose by pollen of Polyanthus: | | | | | | |
| Homomorphic union | 4 | 2 | 32 | 16 | 50 | 800 |
| Heteromorphic union | 4 | 1 | 28 | 28 | 50 | 1400 |

The results of certain unions in this table are most interesting in their bearings on the general phenomena of sterility, and particularly from the excellent illustrations they afford of the extraordinary complexity of the laws of hybridism. We shall best appreciate their bearings on these phenomena, however, by the following comparative details of the results given in the table. In the first place we shall see, as to the relative degrees of fertility resulting from the homomorphic and heteromorphic unions in each of the crosses:—1. In the *homomorphic unions* of the long-styled Cowslip by pollen of the common Primrose the results are 11 seeds per capsule, whereas from an equal number of flowers fertilized HETEROMORPHICALLY every seed-capsule aborted! 2. In the converse unions of these (the long-styled Primrose by pollen of the Cowslip) the results are singularly accordant, the *homomorphic unions* yielding an average of 10 seeds per capsule, while in the HETEROMORPHIC *unions* every seed-capsule is *again abortive*! 3. The *heteromorphic unions* of the long-styled Primrose by pollen of the Polyanthus yield an average of 26 seeds per capsule, and the *homomorphic unions* are utterly sterile. 4. Both unions of the short-styled Primrose by pollen of the Polyanthus are *highly fertile*; the *heteromorphic* also exceeding the *homomorphic unions* in the proportion of 28 to 16 seeds per capsule—that is, as 5 to 3 *. 5. And, lastly, we find that the *heteromorphic unions* of the short-styled Primrose by pollen of the Cowslip are remarkably fertile, yielding an average of 49 seeds per capsule; the *homomorphic unions*, on the other hand, do not yield a single seed!

We have already adduced a few illustrations of the functional relations of the two forms of one species with those of another species, and also expressed our belief, from the teachings of those illustrations, that the RELATIVE *sexual powers* of the two forms of a species did not extend to, or govern the *results* of *unions* between the *respective forms* of two distinct species. How fully, then, are we supported in this view by the results given in the above table! how unequivocally do they show us that functional dimorphism is limited in its operations to the *individuals* of a species! † It is curious to observe how this is borne out by our experiments on the *P. vulgaris* and its modified descendants. Thus, in the above reciprocal unions of Primroses and Polyanthuses, the *heteromorphic unions* in *both* cases exceed the *homomorphic unions*; and so we find it to be in all the unions of the common Primrose with the white variety given in Table V. Though there are certainly great irregularities as to the *grade* of fertility of the different unions, we have still extending through all, the important parallelism that the *heteromorphic* unions in every case exceed the *homomorphic* unions. We thus see (and the fact is most interesting) that though the *Polyanthus* and *White Primrose* have been greatly differentiated with respect to their sexual relations with their common parent, *P. vulgaris*, it is yet insufficient to derange the operations of the laws of dimorphism by rendering the heteromorphic and homomorphic unions indifferently the more fertile. By comparing the relative fertility of the different cross-unions of these forms, however, we are forcibly impressed with the occasional unimportance of structural differences on the functional correlations of distinct forms. Who, for example, in absence of proof, would have suspected that unions between the Polyanthus and the common yellow Primrose would afford a higher grade of fertility than those of the latter (the common Primrose) with the red and white Primroses, which, so far as can be discerned, differ from each other in colour alone? Nevertheless such is the case: we have shown that the red Primrose will not unite with *either* the yellow or white Primrose, and that a very imperfect fertility results from the unions of the two latter forms,—the *united heteromorphic unions* of the common Primrose by pollen of the Polyanthus producing more seed than the *similar unions* of the *former* by pollen of the white Primrose, in about the proportion of twenty-seven to eighteen seeds per capsule, or as three to two!

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* Mr. Darwin, in his letter to me accompanying the above results, remarks that the seeds of this short-styled Primrose were very small; so that we may perhaps suspect a number of them unfit for germination.

† It is highly probable indeed, from the results of the red Primrose (*vide* Table V.), that we may yet have illustrations of the fertile unions of the modified descendants of a species in which the laws of dimorphism may not be observed, and thus have cause to give *it* even a more restricted field of operation.

I have previously stated that individuals of truly dimorphic species occasionally appear with stamens and pistils of an equal length; and also gave an instance of the occurrence of such an individual in *P. Auricula*, with the results of experiments illustrating the effects of such a structure on the functions of reproduction. I will now give an additional and much more remarkable illustration of this from my observations on *P. veris*. Amongst a number of seedling Cowslips I observed an individual with stamens and pistils of an equal length, both reaching the mouth of the corolla-tube. On examination, however, I found it to differ importantly from the non-dimorphic individual of *P. Auricula*. The pollen-grains were as large as, or even larger than, those of normal short-styled plants: the stigma globular, and rough with papillæ,—in fact, a perfect *fac-simile* of that characteristic of the long-styled form! These remarkable relative transpositions in the structure of the sexual organs are, as I will almost immediately show, connected with equally remarkable changes in the functions of reproduction. This will be seen by consulting the following table, comprising the results of nine distinct unions between the three sexual forms.

TABLE VII.—The Three Sexual Forms of *Primula veris*.

| | Number of flowers fertilized. | Total number of capsules produced. | Number of good capsules. | Number of seeds. | Average of seeds per capsule. | By calculation. | |
|---|---|---|---|---|---|---|---|
| | | | | | | Good capsules. | Number of seeds. |
| Red Cowslip, non-dimorphic form, 21 flowers self-fertilized | ... | 16 | 13 | 447 | 34 | 50 | 1719 |
| Red Cowslip, non-dimorphic form, by pollen of long-styled Cowslip | 5 | 3 | 2 | 15 | 7 | 50 | 375 |
| Red Cowslip, non-dimorphic form, by pollen of short-styled Cowslip | 4 | 3 | 3 | 27 | 9 | 50 | 450 |
| Long-styled Cowslip by pollen of non-dimorphic Red Cowslip | 5 | 5 | 4 | 22 | 5 | 50 | 275 |
| Short-styled Cowslip by pollen of non-dimorphic Red Cowslip | 5 | 4 | 4 | 16 | 4 | 50 | 200 |
| Long-styled Cowslip, homomorphic union | 10 | 6 | 5 | 83 | 16 | 50 | 830 |
| Long-styled Cowslip, heteromorphic union | 10 | 9 | 7 | 196 | 28 | 50 | 1400 |
| Short-styled Cowslip, homomorphic union | 7 | 5 | 5 | 58 | 11 | 50 | 580 |
| Short-styled Cowslip, heteromorphic union | 7 | 7 | 7 | 145 | 20 | 50 | 1035 |

In the first line of the above table the results are given of twenty-one flowers naturally fertilized of the equally-stamened and -styled Cowslip; the second to fifth, inclusive, give the results of the reciprocal crosses of the preceding form with the long- and short-styled forms. I have also added, for the sake of comparison, the results of the homomorphic and heteromorphic unions of the latter forms of *P. veris*. If we examine the results given in the fifth column of the table (in which the average of seeds per capsule is shown), we shall see that the highest grade of fertility results from the *self-union* of the *form* with *stamens* and *styles* of an equal length; thus, relatively to the most highly fertile of the other unions given in the table, viz. the long-styled heteromorphic union, we see that the average excess in favour of the former is thirty-four to twenty-eight seeds per capsule, or as five to four![*] A most remarkable contrast is afforded when we compare the fertility of the form with stamens and styles of an equal length with that resulting from the homomorphic unions; thus, taking the long-styled as the more fertile of the homomorphic unions, we see that the average excess of seeds per capsule in favour of the former is eighteen, affording the proportions of two to one! In the four reciprocal unions of the *long-* and *short-styled* forms with the *non-dimorphic* form, the results are remarkably complicated. Thus, the *non-dimorphic* form by pollen of the *long-styled* form yields an average of seven seeds per capsule; and by the converse union, *i. e.* pollen of the former applied to the stigma of the latter form, the average of seeds per capsule is reduced to five, or as four to three. Again, the *non-dimorphic* form by pollen of the *short-styled* form yields an average of nine seeds per capsule, whereas from the converse union the average is only four seeds per capsule—that is, as two to one! In these illustrations we clearly see that a complete derangement of the normal dimorphic relations of the two forms in their converse unions has been effected; thus the short-styled form used as female with the non-dimorphic form yields the lowest grade of fertility—four seeds per capsule, whereas used as male with the non-dimorphic form the highest grade of fertility is afforded—nine seeds per capsule! It is also worthy of notice that the *non-dimorphic* in *both unions* as *female*, with the long- and short-styled forms, exceeds in fertility the converse unions in about the proportion of two to one! The fertility of all these cross-unions, relatively to the pure unions of the long- and short-styled forms, is greatly decreased. Thus the *united short-styled* pure *homomorphic* and *heteromorphic unions* yield more seed, in about the proportion of *three* to *one*, than those from the *united cross-unions* of the *long-styled* and *non-dimorphic form*! Again, we find a great increase in the proportions by making a similar comparison of the pure *long-styled homomorphic and heteromorphic unions* with the *cross-unions* of the *long-styled* and *non-dimorphic* form, the average in this case being as *five* to *one*!

We thus see that the above Cowslip, structurally characterized, as I have previously stated, by an equality in the length of the stamens and styles, and in the resemblance of the pollen-grains and stigmas to those respectively characteristic of the long- and short-styled forms, has also such functional characteristics as render it a normal hermaphrodite representative of the species! We also see that the pollen-grains and stigmas of this non-dimorphic form have become so differentiated with respect to their reciprocal action with those of the long- and short-styled forms, that a *grade* of *sterility* is induced greatly in excess of that which results from the homomorphic relatively to the heteromorphic unions of the latter forms! Now, Mr. Darwin has shown (and my experiments fully confirm it, *vide* Table IV.) that this lessened relative fertility of the homomorphic unions exceeds that resulting from the hybridism of several distinct species relatively to the pure union of those species. In view of such evidence, I think I am fully justified in adding that this *non-dimorphic* form is, in fact, judged by the physiological test so much insisted on by Prof. Huxley, *a new and distinct species.* Here we have an individual differing in colour, and likewise in important points of structure, from either of the forms which at present represent the species. Again, judged by the physiological test, we find a higher degree of sterility resulting from its unions with the two normal forms of the species, than that which results from the unions of other distinct species of Primulas! Certainly then, structurally and physiologically considered, this individual is perfectly entitled to specific honours. One class of naturalists would, indeed, readily admit the validity of such a claim if they had evidence of a constant recurrence of these characteristics; but there is another class which consider ignorance of origin a necessary appanage to this claim!

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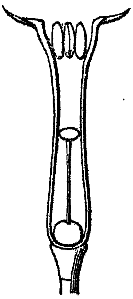
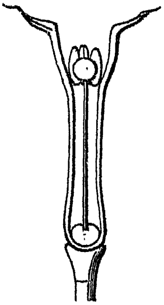
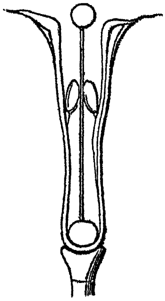
[*] Mr. Darwin informs me those individuals of the *P. Sinensis* which have stamens and styles of an equal length are also more fertile with own pollen than a heteromorphic union!

The foregoing experiments and observations on the non-dimorphic plant were made during its first or spring-flowering period, throughout which, as I have previously stated, a very constant equality was observed in the relative lengths of stamens and pistils in the flowers produced. A similar equality was observed in the relative lengths of these organs in the few flowers produced in its second or autumnal flowering; lately, however, it has produced an umbel in which the relative lengths of these organs in the respective flowers are so singularly variable that I have thought it worth while to give the measurements of each, as well as sketches of a few of the most distinct; thus:—

| Number of flowers. | Length of stamens, in lines. | Length of pistils, in lines. |
|---|---|---|
| 1 | 8 | 5 |
| 2 | 8 | $8\frac{1}{4}$ |
| 3 | $7\frac{1}{4}$ | 7 |
| 4 | 6 | 8 |
| 5 | 7 | $8\frac{1}{4}$ |
| 6 | 6 | 7 |


1.


3.


4.

The numbers attached to the sketches correspond with those in the table of measurements. In the first case (No. 1) the structure is normally short-styled—stamens reaching the mouth of the corolla, pollen-grains large. In the second case (No. 3) the length of the stamens and pistils is nearly equal, and in this respect present the normal non-dimorphic characteristics of the plant, differing from it, however, in both (organs) being shorter than the tube of the corolla, and likewise in the greater variability of the size of the pollen-grains, which, upon the whole, are smaller than those produced by normally structured flowers. Again, in No. 4 we have an approximation to the long-styled structure—the stamens attached somewhat above the middle of the corolla-tube, while the stigma slightly projects from its mouth. The pollen-grains of this flower were plainly smaller than those from any of the other flowers, though undoubtedly more variable in size than those characteristic of the normal long-styled form.

In respect to the functional results of these flowers by fertilization with own pollen I cannot as yet speak, the capsules not being sufficiently matured. Nevertheless I think it will be admitted by all who believe in the gradual modification of organic beings, that, irrespective of any knowledge as to the subsistence of diverse functional correlations between the sexual elements of the individual flowers, the mere structural differences suffice to show us the manner by which the at present normally characteristic "subdiœcious hermaphrodism" of the *P. veris*—and, of course, of all the other dimorphic species of Primalus—has been attained, and, furthermore, take us back to that period in its genealogy when non-dimorphism or perfect hermaphrodism was the genital characteristic of its line. Here, as I believe, we are afforded an instance of variability perfectly analogous to, though certainly less remarkable than, the *Catasetum* case, so ably elucidated by Mr. Darwin. And just as *Catasetum* and *Monochanthus* occasionally produce each other and likewise the hermaphrodite *Myanthus*, thus inducing us to regard the former sexual forms as the modified descendants of the latter, so in the case of the non-dimorphic plant of the Cowslip, we see first the original condition in those flowers whose stamens and pistils are of an equal length, and a mutual adaptation subsisting between their male and female sexual elements, and secondly, the earliest indications of a divergence from that condition and a tendency to the dimorphic in those flowers with stamens and pistils of different lengths.

In the two forms of *Primula Sikkimensis* the stigmas differ little in shape or roughness, but greatly as respects the length of their styles, that of the long-styled being fully four times longer than that of the short-styled form. The stamens in the long-styled form rise little above the ovarium; in the short-styled form they are attached halfway up the corolla-tube; so that the relative differences in the length of these organs in the two forms are much less marked than those of their styles. There are also very marked differences in the pollen-grains of the two forms; those of the long-styled plants are sharply triquetrous, smaller, and more transparent than those of the short-styled, which are of a bluntly triangular shape.

In respect to the relative fertility of the two forms, I may state that when carefully protected from insects they rarely produce a single seed. The long-styled form I have indeed found perfectly sterile when thus protected, while the short-styled form under similar treatment occasionally produces a few seeds. This slightly greater self-productiveness of the latter form is readily explained when we take into consideration the relations of its anthers and stigmas, these being relatively so disposed that it is scarcely possible for the dehiscence of the anthers to take place without a few of the pollen-grains falling upon the stigma. In the long-styled form, on the other hand, where the stigma rises high above the anthers, such a result can only be effected by insects or other external agencies. When both forms, however, are artificially fertilized with their own pollen, we find that the long-styled unions are much the more fertile, exceeding the short-styled in about the proportion of two to one! This I have indeed found to be the case, in a more or less marked degree, in all the dimorphic species on which I have experimented, with the exception of the *P. Auricula* and the *P. vulgaris alba*, as may be seen by referring to the tables previously given of those plants. Mr. Darwin notices (*loc. cit.* p. 92) this relatively decreased grade of fertility in the short-styled homomorphic unions, and very naturally regards it as a quality specially acquired for the counteraction of the greater facilities presented by this form than the other for self-fertilization. Thus, by an increased differentiation of pollen and stigma with respect to their mutual action, Nature renders the short-styled forms equally dependent with the long-styled forms on external agencies for the production of aught above the lowest grade of fertility. And thus, as Mr. Darwin has forcibly urged, one of the great ends of reciprocal dimorphism is more perfectly effected—the greatest facilities afforded for the intercrossing of individuals.

The following table gives the results of my experiments on the two forms of *Primula Sikkimensis*:—

TABLE VIII.—*Primula Sikkimensis.*

| | Number of flowers fertilized. | Number of good capsules produced. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|
| Long-styled homomorphic union...... | 24 | 17 | 248 | 14 |
| Long-styled heteromorphic union ... | 12 | 8 | 285 | 35 |
| Short-styled homomorphic union ... | 14 | 8 | 64 | 8 |
| Short-styled heteromorphic union ... | 12 | 10 | 419 | 42 |
| SUMMARY. | | | | |
| The two homomorphic unions......... | 35 | 25 | 312 | 12 |
| The two heteromorphic unions ...... | 24 | 18 | 704 | 39 |

In the two forms of *Primula cortusoides* the pistil is about three times as long in the one as in the other, the anthers being situated about the middle of the corolla-tube in the long-styled form, and surrounding its mouth in the short-styled form. The longitudinal axis of the long-styled stigmas is double that of the short-styled stigmas, and the stigmatic papillæ of the former are about three times longer than those of the latter. Again, the pollen-grains of the short-styled plants are larger, less transparent, and more bluntly triangular than those from the long-styled plants.

In the following table I have given the results of my experiments on this species:—

TABLE IX.—*Primula cortusoides.*

| | Number of flowers fertilized. | Number of good capsules produced. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|
| Long-styled homomorphic union...... | 10 | 7 | 287 | 41 |
| Long-styled heteromorphic union ... | 8 | 6 | 343 | 51 |
| Short-styled homomorphic union ... | 10 | 6 | 228 | 38 |
| Short-styled heteromorphic union ... | 8 | 8 | 487 | 61 |
| SUMMARY. | | | | |
| The two homomorphic unions......... | 20 | 13 | 515 | 39 |
| The two heteromorphic unions ...... | 16 | 14 | 830 | 59 |

I tried repeatedly to reciprocally hybridize the two forms of *P. cortusoides* with those of *P. Sinensis*, but though I was led to anticipate favourable results from the swelling of several of the capsules, I was ultimately disappointed, as they did not contain a *single good seed.* I was more successful, however, in a similar series of experiments with the *P. cortusoides* and *P. mollis*; the latter, as I have previously stated, is characterized by an equality in the length of the stamens and styles. The results are given in the table beneath. If we compare the results with the pure unions of *P. cortusoides* in Table IX., and with those of *P. mollis*, we shall see that the fertility of both species is greatly decreased; we shall also see that there is still no regularity as to the degree of fertility resulting from the converse unions. Thus, the pure *long-styled homomorphic unions* of *P. cortusoides* yield an average of forty-one seeds per capsule, while by its union with *P. mollis* —the latter being used as male—the average is reduced to five seeds per capsule—that is, as eight to one. The short-styled *P. cortusoides* by pollen of *P. mollis* did not *yield* a *single seed,* though several of the capsules swelled. Higher grades of fertility are seen to result from *P. mollis* as female. Thus, by pollen of the long-styled *P. cortusoides* it yields an average of fifty-one seeds per capsule; by pollen of the short-styled *P. cortusoides* the results are sixty-seven seeds per capsule. Now, from the pure unions of

*P. mollis* the average of seeds per capsule is 165. So that the decreased fertility of the cross-unions relatively to the pure unions of the latter is in the former case as 1 to 3·23, in the latter as 1 to 2·46. Respecting the irregular fertilities of the converse unions we will simply refer to the fact, by way of further supporting our previous remarks on this point, that though the short-styled *P. cortusoides* when used as female with the *P. mollis* is utterly sterile, yet by the converse union of these the highest grade of fertility, relatively to any of the other unions given in the table, is produced. I may also, in passing, notice that the seeds produced upon the long-styled form of *P. cortusoides* were very fine, though the average per capsule is low. Those, on the other hand, produced by *P. mollis*, in its different unions with the long- and short-styled forms of *P. cortusoides*, were so very small, that I entertain little hopes of any of them germinating.

In the following table we have the results of these unions of *P. cortusoides* with *P. mollis*.

TABLE X.—Hybrid unions of *P. cortusoides* with *P. mollis*.

| | Number of flowers fertilized. | Total number of capsules produced. | Number of good capsules. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|---|
| Long-styled *P. cortusoides* by pollen of *P. mollis* ... | 12 | 7 | 5 | 27 | 5 |
| Short-styled *P. cortusoides* by pollen of *P. mollis* ... | 12 | 5 | 0 | 0 | 0 |
| *P. mollis* by pollen of long-styled *P. cortusoides*...... | 10 | 6 | 4 | 205 | 51 |
| *P. mollis* by pollen of short-styled *P. cortusoides*...... | 10 | 8 | 5 | 336 | 67 |

In the two forms of *Primula involucrata* the pistil is about three times longer in the one form than in the other. The stigma of the long-styled form reaches the mouth of the corolla-tube, and the anthers are situated halfway down the tube: in the short-styled form the converse of this takes place, namely, the style is half the length of the corolla-tube, the anthers reaching its mouth. The stigma of the long-styled form is of a globular shape, and closely beset with long papillæ; that of the short-styled form is smooth and depressed on the apex: the pollen-grains of the latter are also larger and less transparent than those of the other form; in both, however, they are of a similar (spherical) shape.

Amongst many failures in my experiments on effecting unions between the *P. involucrata* and other species, I succeeded in getting a few capsules containing good seeds by application of the pollen of the short-styled form of *P. Sibirica* to the long-styled *P. involucrata*; I had also successful results by applying the pollen of the short-styled form of *P. farinosa* to the short-styled *P. involucrata.* I have utterly failed, however, to effect unions by the converse experiments of the above, *i. e.* by applying pollen of the two forms of *P. involucrata* to those of the *P. Sibirica* and the *P. farinosa.* The results of the successful unions were as follows:—1. From the long-styled *heteromorphic unions* of *P. involucrata* by pollen of *P. Sibirica* I got four capsules, which yielded an average of ten seeds each. 2. From the short-styled *homomorphic unions* of *P. involucrata* by pollen of *P. farinosa* I had three capsules, and, in all, seventeen seeds; so that the average in this case is reduced to about six seeds per capsule. If we compare these results with those given in the summary of the united homomorphic unions of *P. involucrata* in the following table, we see that these unions yield more seed, in about the proportion of *three to one*, than those from the heteromorphic union of *P. involucrata* with *P. Sibirica*, and as *five to one* relatively to its homomorphic unions with *P. farinosa.*

TABLE XI.—*Primula involucrata.*

| | Number of flowers fertilized. | Number of good capsules produced. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|
| Long-styled homomorphic union...... | 10 | 6 | 230 | 38 |
| Long-styled heteromorphic union ... | 6 | 4 | 263 | 66 |
| Short-styled homomorphic union...... | 14 | 7 | 195 | 28 |
| Short-styled heteromorphic union ... | 6 | 5 | 347 | 69 |
| SUMMARY. | | | | |
| The two homomorphic unions......... | 24 | 13 | 425 | 32 |
| The two heteromorphic unions ...... | 12 | 9 | 610 | 68 |

In the *Primula farinosa* the pistil of the long-styled form is about twice as long as that of the short-styled form, and elevates the stigma slightly above the mouth of the corolla-tube, while the anthers are attached halfway down the latter. In the short-styled form there is a converse arrangement of these organs observed, the stamens corresponding, or nearly, in length with the pistils of the long-styled form, and the pistils with the stamens of the latter form. The stigmas of the two forms differ little in shape or size, but that of the short-styled form is evidently rougher. The pollen-grains are also of a similar (bluntly triangular) shape in both forms, those of the short-styled being the larger. Besides these two forms, however, characterized as we have seen by a relative inequality in the length of the stamens and pistils, it is not at all uncommon to find individual plants with these organs of an equal length, and reaching the mouth of the corolla-tube. From an examination of specimens, however, from various localities, I have no doubt, from the relatively small size of the pollen-grains as compared with those of the normal long-styled form, that these relations are due to an abnormal development of the stamens. This view is furthermore supported by the functional performances of these organs, as I find, from a few experiments on an equal-stamened and -styled plant in the Botanic Gardens of Edinburgh, that less seed results from its union with the long-styled than with those of the short-styled. The non-dimorphic form of *P. Auricula* (*vide* Table II.) affords an analogous illustration in so far as concerns its functional relations with the long- and short-styled forms of the species. But there is one important difference between the two cases, namely, that the non-dimorphic form of *P. Auricula* is perfectly fertile with own-pollen, whereas the like form of *P. farinosa* is very imperfectly fertile when thus treated! indeed much less so than either homomorphic union. This is seen by referring to the table beneath, where we find that the united homomorphic unions yield more seed, in about the proportion of *two to one*, than those of the equal-stamened and -styled form by own pollen.

In the following table I have given, first, the unions with the equal-stamened and -styled form by own pollen, and secondly, the reciprocal unions of the long- and short-styled forms.

TABLE XII.—*Primula farinosa.*

| | Number of flowers fertilized. | Number of good capsules produced. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|
| Form with stamens and pistils of an equal length by own pollen ......... | 12 | 5 | 62 | 12 |
| Long-styled homomorphic union...... | 14 | 7 | 210 | 30 |
| Long-styled heteromorphic union ... | 8 | 5 | 264 | 52 |
| Short-styled homomorphic union ... | 14 | 8 | 150 | 19 |
| Short-styled heteromorphic union ... | 8 | 7 | 380 | 56 |
| SUMMARY. | | | | |
| The two homomorphic unions......... | 28 | 15 | 360 | 24 |
| The two heteromorphic unions ...... | 16 | 12 | 644 | 54 |

To the above notice of the pure unions of *P. farinosa* I will now add the results of my experiments on the fertilizing it with the pollen of other species; these were chiefly confined to the *P. Scotica*, *Sibirica*, and *involucrata*. In my previous notice of the latter species, I have shown that the short-styled form of *P. farinosa* is capable of fertilizing the short-styled form of *P. involucrata*, and I also stated that I had utterly failed in effecting the converse union of these forms. The latter failures are included in the following experiments on four fine umbels of the long-styled and three of the short-styled form of *P. farinosa.* I carefully fertilized sixty flowers, one half with the long-styled and the other with the short-styled form of *P. involucrata*, yet, though several capsules swelled, they did not contain a single good seed! I also tried reciprocal unions between the two forms of *P. farinosa* and the long-styled form of *P. Sibirica*, but these unions, like the preceding, resulted in the complete abortion of every seed. With *P. farinosa* by pollen of *P. Scotica* I have had a little more success: thus, from twelve flowers of short-styled *P. farinosa* fertilized by pollen of *P. Scotica* I got seven capsules; three of these contained no good seed; the other four yielded in all 91 seeds, which gives an average of nearly 23 seeds per capsule. Now if we refer to the above table of the different unions of *P. farinosa*, we shall see that the fertility of the united homomorphic unions is 24 seeds per capsule, so that these pure unions only exceed the above hybrid unions of the species in the proportion of 100 to 95; *i. e.*, for every hundred seeds yielded by the pure homomorphic unions of *P. farinosa*, 95 are yielded by its hybrid unions with *P. Scotica.* From these results of the *short-styled hybrid* unions, I naturally anticipated, from the evident structural affinities of the two species, somewhat similar results from the *long-styled* unions. In this, however, I was completely wrong; for, after a number of careful experiments, I have failed to get a single seed from the *long-styled P. farinosa* by pollen of *P. Scotica.* How clearly do such cases show us that sterility does not strictly follow systematic affinity. On the other hand, how forcibly do they urge, as Mr. Darwin has well remarked on certain analogous cases, "that the capacity of two species to cross is often connected with constitutional differences imperceptible by us, and confined to the reproductive system." *

We have seen that *dimorphism*, as applied to the structure of the reproductive organs, is a very general, though not, as has been asserted, a universal characteristic of the genus *Primula*, but that several of the species presenting structurally no such relations have, on the other hand, their stamens and pistils of an equal length. Seeing then that the dimorphic structure, in the case of the Primulas, is so invariably correlated with distinctive physiological characteristics, we are naturally led to consider the nature of the reproductive powers of those species which are structurally non-dimorphic, *i. e.* those which have stamens and pistils of an equal length, and see whether or not these structural dissimilarities are connected with any alteration in the functional characteristics of the species. With the view then of illustrating the latter point, I will give the results of a few experiments on three of the latter (non-dimorphic) species.

1. *Primula Scotica.*—The length of the stamens and pistils of this non-dimorphic species varies slightly, as I have already stated, under cultivation: there being a regular correlation, however, observed, in this variation of the sexual organs, the non-dimorphic structure remains unaffected,—the *stigma*, in every case which has come under my observation, being *closely appressed* by the surrounding *anthers.* From this intimate relation of anthers and stigmas, we are naturally inclined to suppose that, after the dehiscence of the anthers, the stigmas will be liberally supplied with pollen. This is not strictly true; the cohesive nature of the pollen-grains still retains them within the open lobes, so that if the flowers be carefully guarded from external disturbance, the *apices* of the stigmas, even in their last stages of decay, are generally found destitute of pollen-grains.

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* 'Origin of Species,' 3rd edit., p. 280.

Even under these conditions, however, an imperfect fertility is induced; as by the dehiscence of the anthers, which closely surround the stigmas, the pollen-grains are brought into immediate contact with the exterior or circumference of the stigma, into which they protrude their tubes, and thus induce a variable though usually a low grade of fertility. This will be seen by an examination of the table beneath, which gives the results from four plants of the *P. Scotica* under the following treatment:—Two of the plants were placed under a shaded bell-glass, and had their flowers artificially fertilized; a third was placed under similar conditions, so as to guard against the aid of all external agencies in the fertilization of the flowers—each of the latter in this case being left to its own innate means; in the fourth, and last, the plant was freely exposed, so as to favour, as far as possible, the action of insects or other agents employed in the fertilization of the flowers.

In Table XIII. the results of the protected and artificially fertilized plants are given in distinct lines, as one of them was very weak and produced two poor umbels, the products of which, united with the other, would give a very unfair idea of the normal average of seeds produced by these plants under the above treatment. If we compare the results, then, of the artificially fertilized flowers in the second line alone with those in the first line, carefully protected from all external fertilizing agencies, we see that the latter, though equally as productive of capsules as the former, nevertheless falls far below it in the *average* of *seeds* per capsule, the proportion in favour of the former being as 2·24 to 1. Again, if we compare the results of the protected and unartificially fertilized flowers with those from the unprotected flowers, given in the fourth line, we see that the latter also exceeds the former in the average of seeds per capsule, in the proportion of 1·87 to 1. Lastly, by comparing the results of the artificially fertilized flowers, in the first line of the table, with those of the unprotected flowers, in the fourth line, we see that the average fertility of the former relatively to the latter is as 1·11 to 1.

We thus see that the *Primula Scotica is* capable of self-fertilization; but, from its extremely imperfect nature, we are rather inclined to regard it as a mere provision against absolute sterility, than to suppose that the plant is habitually dependent on such manifestly imperfect means for its fertilization; that, in fact, in this species, as in the truly dimorphic, fertilization is largely aided by insect or other mechanical agencies; so that, as one of the grand ends of sexual dimorphism is the crossing of distinct individuals, we have, in this imperfect self-fertility, indications of a desire in nature to facilitate similar conjunctions in this non-dimorphic species. As it might be supposed, however, that this imperfect self-fertility was due to a differentiation of a flower's own pollen to its own stigma, I may expressly state that the complete fertility of the artificially fertilized flowers was the result of fertilization in every instance by the flower's own pollen. There can be no doubt, therefore, that the imperfect fertility of the unartificially fertilized flowers was simply owing to the stigmas being insufficiently supplied with pollen. As further supporting this, I may also state, that in my tables where the amount of seeds produced by each capsule is stated separately, much less variation in the amount is presented by those artificially than those naturally fertilized.

TABLE XIII.—*Primula Scotica.*

| | Number of flowers. | Number of flowers fertilized. | Number of capsules produced. | Number of seeds produced. | Average of seeds per capsule. |
|---|---|---|---|---|---|
| Flowers carefully protected from all external fertilizing agencies ........................ | 10 | ... | 6 | 568 | 95 |
| Flowers protected from insects, and artificially fertilized ........................ | ... | 6 | 4 | 852 | 213 |
| Flowers protected from insects, and artificially fertilized ........................ | ... | 14 | 9 | 1249 | 139 |
| Flowers unprotected, and freely exposed to insect and other agencies .............. | ... | 13 | 8 | 1426 | 178 |

2. *Primula mollis.*—The relations of anthers and stigmas in this species, as in the preceding, are highly favourable to self-fertilization, the latter organs being closely surrounded by the former, and included within the tube of the corolla. In respect to its regular self-fertility, it greatly exceeds all the other species with which I have any acquaintance, inasmuch as nearly every flower produces a capsule *filled* with *good seed*; whereas in the other non-dimorphic species which have come under my observation there is very generally a high percentage of abortive capsules, together with a great variability in the number of seeds contained in those that do set. Though I had never seen the flowers of

this species (*P. mollis*) frequented by insects, I carefully protected a few plants, in case this regularly complete fertility might be due in part to such agencies. The seed-produce, however, from these plants was in no way affected; the average of capsules, and of seed per capsule, was quite equal to those from the unprotected plants. The following are the results from a single scape of a protected plant, which I believe affords a fair idea of the average fertility of this species in a cultivated state:—

| | Number of verticils. | Number of flowers. | Total number of capsules. | Number of good capsules. | Number of seeds. | Average of seeds per capsule. |
|---|---|---|---|---|---|---|
| Primula mollis ......... | 4 | 17 | 17 | 14 | 2306 | 165 |

3. We have thus seen, then, that the Primulas *Scotica* and *mollis*, in *function* as in *structure*, are alike *non-dimorphic*. This, however, does not appear to be the case with the following species, *P. verticillata*, which apparently presents an *imperfect functional dimorphism* in conjunction with a non-dimorphic structure! As I have already stated, the anthers in this species are attached to the upper third of the corolla-tube, and in general closely surround the stigma; occasionally, however, the latter rises above the anthers, and even becomes slightly exserted beyond the corolla-tube. In such relations, then, of anthers and stigma as occur in the latter case, it is at once evident that sterility may be simply due to the pollen not reaching the stigma. Anyhow, the existence of plants producing flowers of the latter description renders all but valueless the few observations I had made on the self-sterility of this species under cultivation, previous to the publication of Mr. Darwin's paper on Primula-dimorphism, inasmuch as I was then utterly ignorant of such singular sexual relations, and therefore paid no regard to the relative lengths of the stamens and pistils of those plants which came under my observation. In respect to these I will therefore simply state that for two successive seasons I failed to get a single seed from a fine healthy plant of this species, though each season it produced a profusion of flowers. I have also received a nearly similar testimony from the observations of others, namely, that they rarely ever succeeded in getting seed from *solitary plants* of this species, though they have frequently gathered it when a few plants were growing together. But for the existence,

then, of the form with the stigma rising above the anthers, which I only observed in a *cultivated* state this season, such testimony would have rendered highly probable the view I have taken as to the existence of a functional dimorphism in this species; and this the more especially on taking into consideration the results of the few experiments I have lately had an opportunity of making. It is, indeed, only from the accordance of the latter with my previous observations that I have ventured to refer sterility in this case to a dimorphism in function; and I think I am fully justified in so doing; for how, I ask, can an explanation otherwise be afforded for the low fertility of the hermaphrodite conjunctions and the high fertility of the diœcious conjunctions? That such phenomena are presented by the individuals of this species I will now show by the following details of my experiments.

In the summer of 1862 I examined every flower upon a fine scape of *P. verticillata*, and observed a very general equality in the length of the stamens and pistils. On a subsequent examination I observed more or less pollen on the stigmas of seventeen out of the twenty-three flowers borne upon the scape. The remaining six I therefore artificially fertilized with own pollen. The results, however, were in no respect different from those previously alluded to; a high percentage of the capsules were utterly abortive, and the few which did swell contained *no good seed.*

The results of my experiments this summer (1863) have somewhat modified those of 1862, inasmuch as certain of the flowers fertilized by own pollen have yielded a considerable amount of seed; this will be seen by consulting the following table:—

TABLE XIV.—*Primula verticillata.*

| | Number of flowers fertilized. | Total number of capsules produced. | Number of good capsules. | Number of seeds produced. | Average per capsule. |
|---|---|---|---|---|---|
| Flowers fertilized by own pollen...................... | 18 | 8 | 3 | 769 | 256 |
| Flowers fertilized by pollen from a distinct plant ... | 8 | 5 | 5 | 1245 | 249 |
| Flowers fertilized by pollen from a distinct plant ... | 10 | 8 | 7 | 1957 | 279 |
| SUMMARY. | | | | | |
| Flowers fertilized by own pollen...................... | 18 | 8 | 3 | 769 | 256 |
| Flowers fertilized by pollen from a distinct plant ... | 18 | 13 | 12 | 3202 | 267 |

In the first line of the above table I have given the results from a single scape, each flower of which was artificially fertilized by own pollen; in the second and third lines we have the results of the reciprocal crossings of flowers on distinct individuals; and lastly, for the sake of comparison, I have simply restated the results of the unions with own pollen, and given the united results of the reciprocal unions. If we compare the average of seeds per capsule, we see that the unions with own pollen give an average of four seeds per capsule over those in the second line of the table—fertilized by pollen from a distinct individual; the scape, however, which yielded the latter was very weak, so that it affords a very unfair estimate of the normal fertility of the species under the above treatment. A more just idea of the relative fertility of flowers fertilized by own pollen and those fertilized by that from a distinct individual may be formed by comparing the results of the first and third line of the table, these being the results of two equally healthy scapes. Now, in this case we see that those flowers fertilized by pollen from a distinct individual give an average of twenty-six seeds per capsule over those fertilized by own pollen. The most important fact, however, shown in the above table is the increase in the number of good capsules produced by those flowers fertilized by other's pollen as compared with those fertilized by own pollen. Thus, from eighteen flowers of the latter, treated by own pollen, eight capsules set, but of these only *three* contained good seeds; whereas from the same number of flowers of the former, treated by other's pollen, thirteen capsules set, twelve of which were well filled with good seeds: so that the treating with other's pollen exceeds that by own pollen in the proportion of *four* to *one*!

He who will carefully study these observations and experiments on *P. verticillata* will see those conditional peculiarities of the generative system which I have ascribed to a functional dimorphic quality. He will also see, however, by comparing the results of experiments in 1862 with those of 1863, that the individual and reciprocal—*i. e.* hermaphrodite and diœcious—functional relations of the male and female organs are much too capricious to permit of their assignment to any definite law; they are yet, as it were, mere tracings, or, rather, indications of a tendency to become functionally dimorphic. Apart from the evidence afforded by the low percentage of good capsules produced from fertilization by own pollen relatively to that from the reciprocal fertilization of distinct individuals, this, I think, is clearly shown by the relatively increased percentage of seeds resulting from the latter conjunctions. This relative increase in the percentage of seeds by the reciprocal unions, though certainly much under those usually resulting from a comparison of the homomorphic and heteromorphic unions of Primulas, is nevertheless sufficient to affect importantly the number of the individual representatives; and this the more especially if, as Mr. Darwin forcibly urges, close-breeding has a tendency to weaken the progeny.

Connected with these functional peculiarities there is another point worthy of a passing notice—namely, the variability in the length of the pistil. As I have previously stated, this organ is generally of an equal length with the stamens; occasionally, however, flowers occur in which the stigmas rise above the stamens and project beyond the mouth of the corolla-tube; and again, there are others in which it does not even reach the stamens, while the latter in every case observed by me retain a definite position around the mouth of the corolla-tube. The intimate systematic affinities, already alluded to, of the present species with the *P. floribunda* give the above variabilities an additional interest. In respect to the latter species we have stated that along with normally short-styled plants, others occur in which the stamens and pistils are of an equal length. Guided by analogy, then, we may suppose that as the *P. floribunda* has not as yet attained the, at least provisional, equilibrium of dimorphism, as shown by a percentage of non-dimorphic forms, so these functional and structural peculiarities of the *P. verticillata* are presumptive indications of an ulterior dimorphic tendency.

*Summary.*—The species of *Primula* are variously estimated by authors, many of the forms reputed specific by one being considered as mere varieties by another. Steudel, for example, in his 'Enumeratio Plantarum,' admits 85 species, whereas DeCandolle ('Prodromus') gives only 61—a difference of 24 doubtful forms. Of these varieties or species, then, I have given the sexual characteristics of 54:—36 of which are truly dimorphic, presenting both long- and short-styled forms; 13 in which the long- or short-styled forms, respectively, have alone been observed by me; and 5 species and one variety with non-dimorphic characteristics, *i. e.* presenting stamens and pistils of an equal length.

The allied genera *Hottonia* and *Arctia* have also truly dimorphic species; whereas other allied genera—*Dodecatheon*, *Soldanella*, and

*Cortusa*—are very generally characterized by species presenting the structural characteristics of the long-styled form only, without, however, any decreased fertility arising from their hermaphrodite conjunctions.

The general differences of the two sexual forms may be thus briefly summed up:—First, the long-styled forms have pistils equalling in length the tube of the corolla; stigmas usually larger and rougher; stamens attached to, or frequently below the middle of the corolla-tube, whose diameter is thus expanded upwards; pollen-grains generally smaller and more transparent. Secondly, in the short-styled form the pistil is short, not rising above halfway up the corolla-tube; stigma generally smoother and depressed on the summit; stamens attached to the mouth of the corolla-tube, causing an abrupt expansion; pollen-grains generally larger and more opaque. According to all the trials, these structural differences are accompanied by equally remarkable functional differences, —the pollen of the long stamens being alone adapted to fertilize the long pistils, and the pollen of the short stamens to fertilize the short pistils. By applying, on the other hand, either form pollen to own form stigma, *i. e.* effecting a homomorphic union, the degree of fertility relatively to the above, or heteromorphic union, is greatly decreased. Analogous, though less striking, functional differences, however, occur without any appreciable change of structure, as shown by the *P. verticillata, e. g.*, yielding a much higher grade of fertility by its diœcious than its hermaphrodite conjunctions. Such an instance from a genus whose members are so generally characterized by a sexual dimorphism, naturally leads me to regard it as indicative of the acquirement of similar characteristics. An objection to this view may be urged from the occurrence of species which, having no immediate affinity with any structurally dimorphic species, nevertheless present individuals incapable of fertilization by own pollen, though perfectly susceptible to reciprocal fertilization, either with another individual of the same species, or one of a distinct species. To this category, at least, those who disbelieve in the genetic affinities of organic beings will no doubt refer the case of *P. verticillata*, and simply regard it as further illustrative of our ignorance of the conditions upon which sterility, in its varied grades, depends. Those, on the other hand, who believe in the existence of these genetic relations will look with an intelligent interest upon these functional peculiarities of the *P. verticillata*, and regard them, mayhap, as the primary indications of a tendency to assume those remarkable sexual characteristics of the correlated species, and thus presenting an illustration of incipient dimorphism.

The usual differences in the fertility of the heteromorphic and homomorphic unions will be best appreciated by giving the mean results from the unions of several species. Thus, taking the five heteromorphic and homomorphic unions given above, namely, *P. Auricula, Sikkimensis, cortusoides, involucrata,* and *farinosa,* we see, from the mean results of their combined products, that for every 100 seeds yielded by the heteromorphic unions, only twenty-four are yielded by the homomorphic unions,—the heteromorphic thus exceeding the homomorphic unions in about the proportion of five to three! I have also shown the remarkable fact that the pollen of a distinct species will produce a much higher grade of fertility than an ordinary homomorphic union, *i. e.* a flower's own pollen!

It is well known that A will fertilize B, and B will not fertilize A. I have given instances of this law with Primulas. I have also shown the new and remarkable fact, that of the two forms of the same species the pollen of the one, but not of the other, will fertilize a distinct species! For example, the long-styled *P. Pallinurii* can be fertilized readily by pollen of the long-styled *P. Auricula*; yet, after numerous trials, I have failed to effect a single union between the long-styled form of the *P. Pallinurii* and the short-styled *P. Auricula.* How utterly inconsistent, then, are such facts with the teachings of those who would have us believe that an absolute causal relation exists between the sterility from hybridism and systematic affinity! On the other hand, how unequivocally do these cases show us that the greater or less facility of one species to unite with another is, as Mr. Darwin has sagaciously argued, "incidental on inappreciable differences in their reproductive systems. And that there is no more reason to think that species have been specially endowed with various degrees of sterility to prevent them crossing and blending in nature, than to think that trees have been specially endowed with various and somewhat analogous degrees of difficulty in being grafted together in order to prevent them becoming inarched in our forests."*

Probably the most remarkable result from my observations is that when the dimorphic species cease to be dimorphic, their reproductive functions are greatly modified. Thus, in the case of the Cowslip, for example, we have seen that an ordinary homomorphic union yields about fourteen seeds per capsule, the heteromorphic about twenty-four seeds per capsule, whereas the form with stamens and pistils of an equal length yields, when fertilized with its own pollen, thirty-four seeds per capsule! Thus the non-dimorphic form by own pollen exceeds, first, the homomorphic unions in the proportion of 5 to 2, and secondly, the heteromorphic in the proportion of 3 to 2! Again, from the four different unions of the long- and short-styled forms with the non-dimorphic form, the seed-results in each case fall considerably below an ordinary homomorphic union: thus the mean results of the unions of the non-dimorphic with long- and short-styled are six seeds per capsule, whereas the pure homomorphic unions of the latter give an average of thirteen seeds per capsule—that is, as two to one!

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* 'Origin of Species,' 3rd edit. p. 299.

Connected with these are the remarkable changes in the fertility of the coloured varieties of the Primrose, the red variety yielding no seed when fertilized by pollen of either yellow or white varieties: the reciprocal crosses of these, *i.e.* the pollen of the red variety applied to the stigmas of the yellow and white, are also absolutely sterile! On the other hand, fertile unions may be effected by the reciprocal crossing of the yellow and white varieties, though in every case we have found that the average seed-result of such unions is considerably under that of the pure unions of these forms.

Whether or not the ultimate tendency of dimorphism is a complete separation of the sexes, I think we have the clearest testimony that dimorphism has not always been a genealogical characteristic; and furthermore, that the two forms did not *per saltum* assume these structural and physiological characteristics. I here allude to the evidence afforded by the non-dimorphic Cowslip—namely, the resumption of perfect hermaphrodism, and the occasional production of intermediate stages between this and the normally dimorphic. These, taking us back in the genealogical line, show us an original non-dimorphic progenitor, and the graduated plan by which it gave rise to a dimorphically characterized race.

# A few Notes on the Fecundation of Orchids and their Morphology.

By Dr. H. Crüger, Director of the Botanical Garden, Trinidad.

Communicated by Charles Darwin, Esq., F.R.S.

[Read March 3, 1864.]

[Plate IX.]

Whoever has read C. Darwin's remarkable work on the fecundation of Orchids must have regretted that the chapters on tropical and other foreign Orchids leave a certain amount of uncertainty on the mind of the reader until the observations and suppositions shall have been endorsed by actual facts observed in the native countries of these plants. To fill up, as far as lies in my power, this blank is the purpose of the following observations and notes, to which I have added some remarks which I hope will not be deemed out of place.

Of the larger-flowered *Catasetideæ* we have here in Trinidad three genera (defining the section somewhat differently from Dr. Lindley). These are *Catasetum*, *Coryanthes*, and *Stanhopea*. Of the first we have one species, *C. tridentatum*, very common, and in various varieties, of which some authors have thought proper to make species. It shows in this island both the extreme forms, which I do not hesitate to call male and female; very frequently intermediate forms may be seen. I may state at once that these latter are always sterile. The two principal forms have been described so often, and latterly so well by Darwin, that I may restrict myself to a very few words, bearing principally on the essential parts for fecundation.

The anther and pollen of the male flower are principally distinguished by size and quantity from the corresponding parts in the female flower; the microscopic character of the pollen-tetrades is the same in both. We shall see further on that it is not so with their physiological action. The anther of the female flower drops off immediately after the opening of the same, *i. e.* before the flower has reached perfection as regards colour, size, and smell. The disk (of Darwin; caudicle of other authors) does not cohere, or very slightly, to the pollen-masses, but drops off about the same time, with the anther. In the male flower, where the pollen-masses, &c., are in a much more considerable state of development, the deficiency is in the conducting tissue (*tela conductrix*), which is the true stigma of this and allied plants as far as function is concerned. While in the male flower there is only a thin layer of this tissue lining the stigmatic canal, it is very abundant in the female flower, mixed with a large quantity of sweetish mucosity. This secretion, while it probably causes the disaggregation of the cells of the conducting tissue, has the property of separating the pollen-cells when these latter are brought into contact with it. I could not, however, discover any difference in this respect between the pollinia of male and female flowers, for both were acted on in the same way; but there the resemblance ceases. Left a little longer in contact with this mucosity, the pollen-cells of the male push forth a vigorous vegetation of pollen-tubes, while from the pollen of the female only here and there a rudimentary tube may be seen.

I would here remark, that this action of the sweet mucosity on the cohering tissues of the pollen appears to me to belong to the phenomena of fermentation, in its wider sense. The same effect is produced by substances in a state of decomposition, and may be compared in some manner to the ripening of fruit. It must not, however, be confounded with the action of boiling on certain tissues of roots, where it is explained, according to recent researches, by the conversion of the outer layers of cells into pectose, which is rendered soft by boiling in water.

Although I have tried, like others before me, repeatedly to impregnate a male flower with its own pollen, I have always failed. The incomplete development of the conducting tissue explains this sufficiently. On the other hand, the operation never fails with the female flower when male pollen-masses are applied to it at the proper moment. The action of female pollen is at first not to be distinguished from that of male pollen, but until now I have not seen a case of complete success. The ovarium enlarges, the labellum &c. fade, pollen-tubes are emitted; but after a week or so the ovarium begins to fade, turns yellow, and finally drops, without bringing any seeds to perfection, or even without fecundation taking place.

Many years ago, when specially occupied with the more intimate phenomena of fecundation in plants, I pointed out (Bot. Zeitung, 1851) that pollen, besides giving the material foundation (*sit venia verbo*) for the pollen-tubes, has an evident power of stimulating a flower to development—to the production of ovules or their perfection. Dr. Hildebrand has lately (Bot. Zeitung, 1863, Nos. 44 & 45) published detailed observations on this subject, without however stating anything not previously known. Does not the female pollen of *Catacetum* possess only one-half of the functions of the male pollen? In answering this question it should not be forgotten that both powers, although they admit of being considered separately, may be only consequences of the same physiological quality.

From the above it is made evident that the fecundation of the female flower must take place by means of the pollen of the male flower, as in other plants with distinct sexes. As fruit on this plant is extremely common, it is impossible to attribute it to any other agency than that of insects. And here I have had occasion to verify the supposition of Darwin to its fullest extent.

The female flower opens when still comparatively young, as already mentioned. The male flower emits a peculiar smell about twenty-four hours after opening, and the antennæ assume their greatest irritability at the same time. A large humble-bee, noisy and quarrelsome, is now attracted to the flowers by the smell, and a great number of them may be seen every morning for a few hours disputing with each other for a place in the interior of the labellum, for the purpose of gnawing off the cellular tissue on the side opposite to the column, so that they turn their backs to the latter. As soon as they touch the upper antenna of the male flower, the pollen-mass, with its disk and gland, is fixed on their back, and they are often seen flying about with this peculiar-looking ornament on them. I have never seen it attached except to the very middle of the thorax. When the bee walks about, the pollen-mass lies flat on the back and wings; but when the insect enters a female flower, always with the labellum turned upwards, the pollinium, which is hinged to the gland by elastic tissue, falls back by its own weight and rests on the anterior face of the column. When the insect returns backwards from the flower, the pollinia are caught by the upper margin of the stigmatic cavity, which projects a little beyond the face of the column; and if the gland be then detached from the back of the insect, or the tissues which connect the pollinia with the caudicle, or this with the gland, break, fecundation takes place. I have been an eye-witness only of the first event; I conceive, however, the possibility of the other.

I have tried to represent the above by a sketch (Pl. IX. figs. 1, 2, 3). That the insects are attracted at first by the smell of the flower I take from the fact that the same insect visits *Coryanthes macrantha*, *Stanhopea grandiflora*, and *Gloxinia maculata*, all three of which have the same perfume. But the smell probably only gives notice to the insects; the substance they really come for, in the case of these Orchids, is the interior lining of the labellum, which they gnaw off with great industry, and for which there is a continual contest. The same substance is also very attractive to other insects, such as cockroaches, &c.

This same substance, *i. e.* some cellular tissue which these humble-bees gnaw off, exists also in the hypochil of *Coryanthes macrantha*. They are seen in great numbers disputing with each other for a place on the edge of the hypochil. Partly by this contest, partly perhaps intoxicated by the matter they are indulging in, they tumble down into the "bucket," half-full of a fluid secreted by organs situated at the base of the column. They then crawl along in the water towards the anterior side of the bucket, where there is a passage for them between the opening of this and the column. If one is early on the look-out, as these Hymenopters are early risers, one can see in every flower how fecundation is performed. The humble-bee, in forcing its way out of its involuntary bath, has to exert itself considerably, as the mouth of the epichil and the face of the column fit together exactly, and are very stiff and elastic. The first bee, then, which is immersed will have the gland of the pollen-mass glued to its back. The insect then generally gets through the passage, and comes out with this peculiar appendage, to return nearly immediately to its feast, when it is generally precipitated a second time into the bucket, passing out through the same opening, and so inserting the pollen-masses into the stigma while it forces its way out, and thereby impregnating either the same or some other flower. I have often seen this; and sometimes there are so many of these humble-bees assembled that there is a continual procession of them through the passage specified.

I have not seen the fecundation of *Stanhopea*; it is visited by the same insect, and I have caught it with the pollen-mass of the plant on its back, but I do not see how it can insert the same into the stigma. The insect visits this flower again for the purpose of gnawing off some substance from the labellum; but the same is so far removed from the stigma, that it could hardly, in the fully-opened flower, perform the act of impregnation except in very rare cases and accidentally. I may say that *Stanhopea grandiflora* very rarely bears seeds.

The disposition of *Stanhopea*, and partly of *Catasetum*, where there is no stigmatic liquid substance secreted at the exterior of the column, and where consequently the pollinia have to be inserted into the stigmatic transverse cleft, is repeated in *Gongora maculata*, L. (figs. 4, 5, 6, magnified). This plant often bears fruit.

It is visited, exclusively during the day, as far as I can see, by a splendid bee, probably a *Euglossa*, but with the tongue nearly twice as long as the body. The tongue passes out behind the abdomen, and is there curved upwards. As these also only come for biting and gnawing the anterior side of the labellum, the protruding tongue touches or approaches the gland at every retrograde movement of the insect. By this it can hardly fail to be loaded sooner or later with the pollen-masses, which are then easily inserted into the stigmatic cleft. I have, however, not as yet observed this fact.

While in *Catasetum* one flower is always impregnated by pollen of another, the possibility of self-impregnation exists in the other three examples, and I have no doubt that it often happens. In *Epidendreæ* I have also noticed it many times; and I believe it is owing, in the latter cases, to the abundance of stigmatic viscosity on the face of the stigma, which is situated, in nearly all plants of this suborder, immediately below the pollen-bed. We have here in Trinidad three plants belonging to *Epidendreæ*—a *Schomburgkia*, a *Cattleya*, and an *Epidendrum*—which rarely open their flowers, and invariably are impregnated when they do not open them. In these cases it is easily seen that the pollen-masses have been acted upon by the stigmatic fluid, and that the pollen-tubes descend from the masses still *in situ* down into the ovarian canal. This has also been shown to be the case in a certain class of dimorphic flowers, as in *Viola* and *Oxalis*, where the pollen emits tubes from the anthers, which tubes enter the stigma and descend to the ovules (see H. v. Mohl, Bot. Zeitung, 1863, Nos. 42 & 43).

But, surrounded as we are by innumerable facts demonstrating that self-impregnation is, contrary to what was formerly supposed, *not* the rule, and *necessary* self-impregnation an extremely rare case, I must entirely demur to the conclusion that these few facts are destructive to the Darwinian theory, or, as Mohl has it, are of equal value to prove a contrary theory. Probabilities deduced from the number of observed facts must always enter for a large part into our theories, in sciences of a complex nature. It is true that a *complete* theory admits of no exceptions; but nobody will, I believe, maintain that the above theory has arrived at that state. A few residual facts will not disturb our admiration for it, and the harmony into which it has brought so many branches of natural history hitherto unconnected. As far as intercrossing, and the gradual variation and transformation arising therefrom especially are concerned, there is no necessity to represent to ourselves the process as absolutely uniform. It is necessarily continuous; but it may have an undulatory character, and present a series of maxima and minima. The process of self-impregnation, which does not exclude, as far as I can see, slow modification, would indicate a period of minimum of transformation.

I shall conclude this by a few observations on the morphology of the Orchid flower. The generally received opinion is that six stamens are partly contained in the column and partly in the labellum. Endlicher went so far as to propound that part of the style was also sunk in the labellum. I have for many years ('Linnæa,' xxii. 1849, translated by Henfrey in 'Scientific Memoirs,' part ii.) been acquainted with facts which support this idea. Subsequent studies, however, have modified my views on the subject, based principally on the development of the flower.

As long as the labellum of the Orchid flower is considered a complex organ, it separates the family from all those that might be compared with it—it stands quite alone. Besides, its degree of complexity is not fixed, as we have seen that Endlicher considers some of the "natura stylina" as entering into its composition. A most unphilosophic view has been taken of the various excrescences and lobes of the column and labellum, showing how the weeds of fantastic morphology will grow in the absence of guiding principles.

Writers like R. Brown and Darwin, who felt that simple fancies were insufficient in a matter of this importance, have thought that the distribution of the vascular cords in the axis at various heights would, if not decide the question, at least bring it near its solution. The result of their investigation has been favourable to the idea that the column consists of seven, and the labellum of three originally distinct organs.

The production and multiplication of vascular cords and their distribution belongs, however, to quite a different class of phenomena, and has only an indirect relation to what I should call morphologic tendencies or impulses. Like dehiscence, disarticulation, production of pollen, ovules, nectar, &c., it belongs to physiologic activity. Darwin accounts for the one by the genetic relation which exists between different beings and organs: for the other by adaptation, itself again consequent on natural selection, often giving by this happy idea the death-blow to the sterile and unhealthy principle of final causes. To persons who have dissected much, it must be evident that the transition of vascular cords into a given organ depends on their number principally, and on the relative space which the organ occupies on the axis at the time of its origin, and that their subsequent multiplication is equally dependent on the quantity of tissue which composes the organ in question.

If we look upon the labellum as a simple organ, the family is variously connected with the remainder of the Monocotyledons, and the labellum finds its analogue in various families of both great divisions of the vegetable kingdom (Phanerogams). At the same time the column must contain the nine interior organs of the flower, or, as I would express it, it is here where they partly have not made their appearance.

R. Brown, as is well known, first showed the great importance of organogenetic studies in questions of this kind. He was not led by them in this case, not perhaps admitting that these investigations are always decisive. Others, myself amongst the number, have tried to solve the question in this manner, and finished by owning that the decision was doubtful. Yet, if we consider how many other dark points have been settled by such research, I think the soberest course will always be to try our morphologic speculations on the touchstone of the same, and to accept nothing that has not been ratified by it.

It will be sufficient to describe shortly the development of the Orchid flower to bring out the important points which bear on the question at issue. I shall choose a common plant, *Catasetum tridentatum*. The three sepals appear at the same time, and are followed immediately by the two lateral petals. The labellum makes its appearance only after these, which accounts for its being generally partly covered by them. As the axis grows during this time, the labellum stands a little higher on it than the petals which theoretically belong to the same whorl. Nearly simultaneous with the appearance of the labellum is that of the anther, but the former occupies a larger space on the part of the flower where both are situated.

After this the flower becomes more hollow at the bottom, and the first traces of the ovarian cavity appear. The next organ which becomes visible is the anterior segment of the stigma, as a scarcely perceptible swelling between the upper end of the anther and the ovarian cavity (figs. 7 & 8, *x*). The next change we observe is the appearance of two smaller swellings under the labellum (fig. 11), which, however, soon merge into one (fig. 13), while the anterior lobe takes a rapid development (figs. 9, 10, 12). While in this instance the two posterior lobes of the stigma, represented by the above little swellings, soon unite, in other plants (*Vanilla* e. g.) they remain divided. This state of things (*i. e.* a part of the stigma standing on the posterior side of the flower) lasts comparatively a long time; it is only late that, by an elongation of the axial part of the flower and a partial reversion, the stigmatic aperture is fixed on one side of the column, and a more or less considerable distance is created between its posterior lobe and the base of the labellum.

This is, I believe, the common mode of development; the bottom of the flower, marked by the undeveloped stigmata, is carried up nearly to the top of the column. In *Cypripedieæ* it is, as far as I can see, rather different, the parts of the stigma being more developed (fig. 16, *Selenipedium palmifolium*, Rchb. fil., column; fig. 17, the same very young) and more distinct from each other, even at a very early period. As this is the only plant of that section which grows wild here, I cannot contrast this with other species*.

The various appendages, excrescences, &c., which are observed on the full-grown column and labellum of so many Orchids are of very late origin, and prove their unessential nature in a morphological point of view, whatever their physiological importance may be.

From the above history of development I draw the following conclusions:—

The eccentric development of the Orchid flower begins with the labellum; and it explains why, when the other perigonial leaves are connected, it remains free, and also the frequent connexion of the same with the column. The successive appearance of the parts of the stigma is another consequence of the above eccentricity.

The part of the axis which bears the stigmata, and the organs immediately surrounding these, of which generally five, sometimes four, do not make their appearance, is afterwards considerably lengthened, and at the same time the eccentric development causes a partial reversal of its apex, and generally the bent or prostrate position of the anther, originally erect.

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* This *Selenipedium*, which bears a small, very fragrant vanilla, is in all probability always impregnated by insects. The labellum is, like some Aristolochia-flowers, constructed after the fish-pot system, *i. e.* a funnel-shaped opening conducts into it, and insects find it difficult to escape through the same. The only other opening near the base of the labellum is partly closed by the sexual apparatus, and the insect has to force its way out there.

It is clear that the *Neottieæ*, in the later stages of their development, must have some differences.

As an example of an Orchid where the eccentric development of the flower is reduced to its lowest degree may be quoted *Thelychiton*, Endl. Iconogr. t. 29, where the stigma is central, surrounded by a six-lobed cup, bearing on one of its lobes the anther.

The only example that I am acquainted with of an Orchid flower in which all the stamens make their appearance, or nearly all, is a species of *Isochilus*, found here common enough, and in which this irregularity is very frequent. The flower is normally triandrous, but very often bears five anthers, with a filament proceeding from the front of the column just beneath the stigmatic cavity (fig. 18). If this filament should ever be found to bear an anther, we should have the Orchid flower restored.

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## On the Double Cocoa-nut of the Seychelles (*Lodoicea Sechellarum*) "Sea Cocoa-nut," "Double Cocoa-nut," "Coco de mer." By SWINBURN WARD, Esq., Civil Commissioner. Communicated by Sir W. J. HOOKER*, F.R.S. & L.S., &c.

[Read March 3, 1864.]

THIS extraordinary specimen of the Palm tribe, the largest and most curious of all the many varied kinds scattered over all tropical regions, is found only in two small islands belonging to the Seychelles Group, "Praslin" and "Curieuse," which lie in juxtaposition between 4° and 5° of S. lat., and 55°–56° E. long., —nearly three hundred miles north-east of Madagascar, which, though itself an island, may, from its immense size, be legitimately considered the nearest mainland.

The name by which it is best known, that of "Coco de mer," was given to it by some French navigators who had picked up the nut floating at sea, and being unable to ascertain anything respecting the tree that produced it, supposed it to be the production of some unknown submarine plant. It has often been found on the coasts of Ceylon and the Maldive Islands, drifted thither by some of the mysterious currents which perplex mariners all over the Indian Ocean. The nuts attained in these countries to an almost religious value, and were sold in India for fabulous prices. A medicine was made of the kernel, which was said to possess restorative qualities much in request in those countries where polygamy prevails.

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* In a letter received from Mr. Ward, he requests me to accompany this communication with a statement that several of the facts here described were also noticed by Dr. Barnard, and published in a volume of the Asiatic Society's Journal, and that these have all been verified by himself.—W. J. HOOKER.

It was not until the discovery of the Seychelles Islands by the French in 1742 that authentic information was obtained respecting the true nature of the tree, and the astonishment of those previously acquainted with the Coco de mer may well be imagined upon their finding large forests entirely composed of this Palm, growing most luxuriantly upon a small and quite uninhabited island, and towering far above all ordinary tropical vegetation.

But little is even now known respecting the growth and peculiarities of this extraordinary Palm, owing to the great length of time it requires to arrive at maturity, and the consequent difficulty of obtaining accurate information with regard to its development. The information gathered from the inhabitants is not of much value; they are very unobservant, and the truth of their replies to any questions that may be put to them can never be depended upon.

The shortest period before the tree puts forth its buds is thirty years, and one hundred years must elapse before it attains its full growth. No one can tell how long it will last, or how old some of the gigantic specimens may be. No nuts planted since the British came into possession have arrived at their full growth. One in the garden at Government House, planted fifteen years ago, is still quite in its infancy, about sixteen feet in height, but with no stem yet visible, the long leaves shooting from the earth like the Traveller's Palm (*Urania speciosa*), and much resembling them in shape, only much larger. Nine months after the nut has been planted, supposing germination to have begun at once, the leaf sprouts at an angle of 45° from the root; it is very closely folded, with a smooth hard surface, terminating in a sharp point. When about two feet above the surface it expands, and nine months after another leaf follows, coming up the grooved surface of the midrib of that which preceded it, and so on at intervals of nine months, each succeeding leaf becoming larger in size. All these leaves cluster together and support each other, no stem appearing above the ground. From the age of fifteen to twenty-five the tree is in its greatest beauty, and the leaves at this period much larger than they are subsequently. They consist of two layers of fibres crossing each other at right angles, imbedded in a thick stratum of parenchyma enclosed in a tough skin.

The stem of the full-grown tree, like that of all Palms, consists of hard fibres imbedded in medullary substance enclosed in a hard sheath, so hard that a good axe is required to cut it. It splits readily, but is extremely durable. Unlike the Cocoa-nut trees, which bend to every gentle gale (*flecti sed non frangi*), and are never quite straight, the Coco de mer trees are as upright as iron pillars (*frangi sed non flecti*), undisturbed in their position by the heavy gales and violent storms so often occurring in tropical regions.

At the age of thirty the tree first puts forth its blossoms. The male and female trees are quite distinct; and the female blossom may be considered as the germ of the nut, as it offers nothing of the appearance of what is generally regarded as a blossom. The female tree alone produces the nut, and it is twenty feet shorter than the male tree, which frequently attains a height of one hundred feet.

The male flower is an enormous catkin, about three feet in length and three inches in diameter, of a reddish-brown colour, and covered with rhomboidal valvate scales disposed spirally about the stem, from the angles of which the stamens spring. Within its circumference, at intervals corresponding to the apertures from which the stamens shoot, are found little masses containing such a succession of stamens in progressive stages of development that the flowering is maintained for eight or ten years, each coming stamen thrusting off and replacing the one that preceded it. The whole has a most disagreeable, oily odour, and if cut and put in any accessible place, is greedily attacked by ants. It may be seen in all stages upon the same tree—in full bloom, faded, and quite decayed.

The female blossoms spring from a strong stem forming a regular zigzag, and are composed of three bracts three or four inches in diameter. A gummy secretion exudes from the apex of these, which secretion doubtless arrests and secures the pollen necessary for their fecundation. The fruit-stalk is supported by three very strong bracts; the outer one of these, the top of which is wedge-shaped, penetrates the stalk of the leaf immediately above it, in the under side of which nature has left a fissure accessible to it. By this provision the stalk is enabled to support the weight of fruit which hangs upon it, sometimes exceeding four hundredweight. Eleven nuts have been seen on one stalk, the probable weight of each being about forty pounds. Such clusters are, however, very rare, and four or five may be taken as the average number on one stalk.

From fructification to full maturity a period of nearly ten years elapses. The fruit attains its full size in about four years, and is then soft, and full of a semitransparent jelly-like substance of an insipid, sweetish taste. The mesocarp is a leathery substance of a brownish-green colour, adhering to the shell. As the nut ripens this gradually dries up into a white, horny kernel, about half an inch in thickness, and of no use whatever, supposed to be poisonous, but, probably, only quite indigestible. The nut in its perfect state is about eighteen inches long, and of the same breadth, something in the shape of a heart, with two separate compartments. It is enveloped, like the Cocoa-nut, in a fibrous husk; but its texture is not nearly so thick or so strong, and it drops off soon after the nut falls from the tree. The nuts, sawn in half and divested of the kernel, form excellent calabashes, and are universally used for baling boats. The entire nut is frequently used as a water-keg, and holds three or four gallons of water. It has, however, to be "caulked" in the centre, where germination takes place, before it becomes completely water-tight.

The arrangements provided by nature for the roots of both male and female trees are of a most peculiar nature, quite distinct from those provided for any other known tree. The base of the trunk is of a bulbous form, and this bulb fits into a natural bowl, or socket, about two and a half feet in diameter and eighteen inches in depth, narrowing towards the bottom. This bowl is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never, however, becoming attached to the bowl; their partial elasticity affording an almost imperceptible but very necessary "play" to the parent stem when struggling against the force of violent gales.

This bowl is of the same substance as the shell of the nut, only much thicker. As far as can be ascertained, it never rots or wears out. It has been found quite perfect and entire in every respect sixty years after the tree has been cut down. At Curieuse many sockets are still remaining which are known to have belonged to trees cut down by the first settlers on the island.

This curious arrangement renders it impossible that the trunk could grow in a slanting position; and there is no known instance of its doing so, either on the flat, or on the steep sides of the mountains, in both of which situations the tree thrives equally well.

The high price still fetched by the nuts will ultimately be the cause of their complete extinction in these islands. The growth of the Palm is so very slow that no one can expect to reap where he has sowed, and the people consequently never take the trouble to plant any for the benefit of posterity. Not content too with digging up those nuts that have fallen and taken root, they ruthlessly destroy whole trees by cutting them down for the sake of the nuts and the heart leaves, which latter are used for making hats, fans, and baskets. Many of the trees still standing are quite spoilt by the practice of cutting out these centre, or heart, leaves, leaving the tree shorn of its beauty, and with an untidy, ragged appearance. Besides the ravages of man, fire is a terrible enemy to these forests, a year seldom elapsing without their being sufferers by accidental conflagrations, especially those forests situated at the north-west end of Praslin, in which are now found only such male trees that from their height overtopped the flames that destroyed the females. At the south-east end of Praslin they are more plentiful, the dry season being in the south-east monsoon, and as the forests are to windward, they are not exposed to much danger from spreading fire.

No suggestions will induce proprietors to abandon their present habit of wilfully destroying the trees for the sake of the nuts and leaves, or to take some pains for the cultivation and reproduction of this magnificent Palm. Not many years will elapse before the Coco de mer becomes in reality as rare as it was supposed to be when first picked up at sea by the wondering mariners, and the only relics left of its former magnificence will be the decaying blackened stumps of the trees so wantonly destroyed, and the curious sockets in which they stood for so many years.

Seychelles, April 16, 1863.

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## Observations on a peculiar Mode of Fructification in *Chionyphe Carteri*, Berk. By the Rev. M. J. Berkeley, M.A., F.L.S.

[Read March 3, 1864.]

[Plate X.]

I have given, in the 'Intellectual Observer' for November 1862, an account of that formidable disease, the Fungus-foot of India, from information derived partly from Dr. H. Vandyke Carter and partly from his colleague Mr. H. J. Carter, together with a figure of the curious mould to which it is believed that it owes its origin. The latter gentleman, besides placing all his sketches at my disposal, gave me specimens of the mould, in such a condition that it was hoped I might be able to raise a crop in the following spring upon rice-paste, to enable me to examine its characters more closely than Mr. Carter had been able to do, as he had not made an especial study of the minute Fungi.

It was the more desirable to do this as the *Chionyphe* as seen by Mr. Carter exhibited more than one form of fructification, in one of which a multitude of globose spores were formed within the terminal cyst; in another, if not an earlier stage of the same thing a few secondary cysts were produced within the mother cyst; while in a third, instead of globose spores there were myriads of more minute fusiform bodies. These secondary cysts, it should be observed, are unlike anything observed hitherto in *Chionyphe* or *Mucor*, though approaching certain appearances in *Saprolegnia* and its allies.

The resemblance, however, to these plants did not stop here, for in certain cysts lateral branchlets formed a reticulated mass over the surface, reminding one strongly of the antheridia in *Saprolegnia monoica*, Pringsheim*, or of the supposed antheridia figured by Hofmeister† in Truffles.

Those who are familiar with the various modes of fructification in Fungi, and more especially if they have studied the *Saprolegniæ*, will not be surprised at these anomalies, or at the additional proofs afforded by them of the affinity which really exists between the *Mucorini* and *Saprolegniæ*.

As early as 1823, Carus‡ observed that of two portions of a dead salamander which was infested with some incipient mould, one which was immersed in water produced an *Achlya*, while that which was kept moist in air gave rise to a species of *Mucor*. This was hailed as a strong argument in favour of the theories then prevalent in Germany relative to equivocal generation; but it was, in fact, an indication of that plurality of forms of fruit which is now known to exist in so many Fungi. The relation has not, however, been generally acknowledged, insomuch that the *Saprolegniæ* have by most authors been referred to Algæ rather than to Fungi. Later discoveries, however, of the existence of spores resembling Infusoria in the genus *Peronospora*, to which the Potato-mould belongs, not to mention the Myxogastres, have apparently modified opinions, and at the present moment botanists seem inclined to acknowledge the justice of the views I have entertained on the subject in the 'Introduction to Cryptogamic Botany,' p. 10.

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* Jahrbücher für wissenschaftliche Botanik, Band 1. tab. 19.

† Pringsheim, Jahrbücher, Band 2. tab. 33–35.

‡ Act. Leop. 1823, tab. 58.

On every account, therefore, it was a matter of some interest to watch, if possible, the development of the *Chionyphe.* As soon, then, as the weather was sufficiently warm in the spring of 1863, minute fragments of my specimens were placed upon thick rice-paste, and each was covered with a bell-glass to prevent any accession of fresh spores from without. Unfortunately, however, our native moulds rapidly made their appearance in great abundance, and it was only after they had arrived at perfection that the pink patches of the *Chionyphe* became conspicuous, and these were so intermixed with the strangers that it was very difficult to follow out their development; added to which the rice-paste seemed to be so exhausted by the first-formed moulds, that the vegetation of the *Chionyphe* ceased before the greater part of the fruit was perfected. As far, however, as my observations go, they confirm Mr. Carter's remarks. There were two kinds of *Hyphasma,* the one consisting of irregular branched and anastomosing, sparingly-jointed threads, which seemed to give rise to the Mucorioid fruit; the other of straight Confervoid threads (which appear to be identical with those figured by Mr. Carter), in whose articulations there was a minute nucleus at the upper part, while in the terminal articulation there were sometimes two, though I was not able to verify this minute character. There were the same cysts of the second order in some of the mother cysts, and there were spores germinating *in situ,* though these appeared to me elliptic rather than globose.

Though, however, I did not see all that Mr. Carter has figured, a most curious matter, in addition, was exhibited by the straight threads, which point to another curious analogy with certain Algæ.

The portion of the protoplasm or contents of the cells in which Mr. Carter observed the nucleus above mentioned to be immersed soon separated from the rest, first presenting a cask-shaped mass, surrounded or not with a distinct membrane, and then becoming elliptic or subglobose. A large nucleus was observed in many of these masses, but this appeared to be frequently replaced by an indefinite number of smaller bodies. After a time a little papilla is formed on one side exactly as in the fructifying joints of *Zygnema,* which gradually bulges out, the mass soon conforming itself more or less to its enlarged walls. In a single case only I witnessed the junction with another thread (Pl. X. fig. 6), and then the form of the intermediate cyst was extremely irregular and its cavity filled with large spores.

In some threads, however, a different state of things appeared, sometimes in the centre, sometimes at the apex, but whether in either case corresponding with a twin nucleus I am unable to say. However this may be, instead of one cyst, two appeared, a conjugation probably taking place between the two within the thread, as in some *Zygnemata*, and the upper forming it should seem ultimately the perfect cyst. Not one cyst, however, came to perfection. In some cases (fig. 4) the lower cyst seemed to be entirely absorbed, while in others (fig. 5) it was permanently connected with the upper by a distinct neck. In one instance I saw one of the straight threads forked, and producing two terminal cysts.

From the circumstances before mentioned, it was impossible for me to follow out each point with the requisite precision, and I ought perhaps to apologize to the Society for submitting to it observations confessedly so imperfect. As, however, they relate to an extremely interesting matter and are highly suggestive, while, as far as they go, they give evidence of the correctness of Mr. Carter's sketches, I have imagined that they may possess sufficient importance to command a moment's attention. The conjugation of the threads seems to resemble more closely that of *Zygnema* than the well-known analogous phenomenon in the genus *Syzygites*.

## EXPLANATION OF PLATE X.

Fig. 1. A portion of the *Hyphasma* which gives rise to the Mucorioid cysts, figs. 7 & 8.

Fig. 2. Straight threads with one or two nuclei at the upper part of each articulation: after Mr. Carter.

Fig. 3. Separation of cysts from the protoplasm in different states.

Fig. 4. A double cyst formed in one of the joints, and a cyst which has become free above, the second cyst having been absorbed.

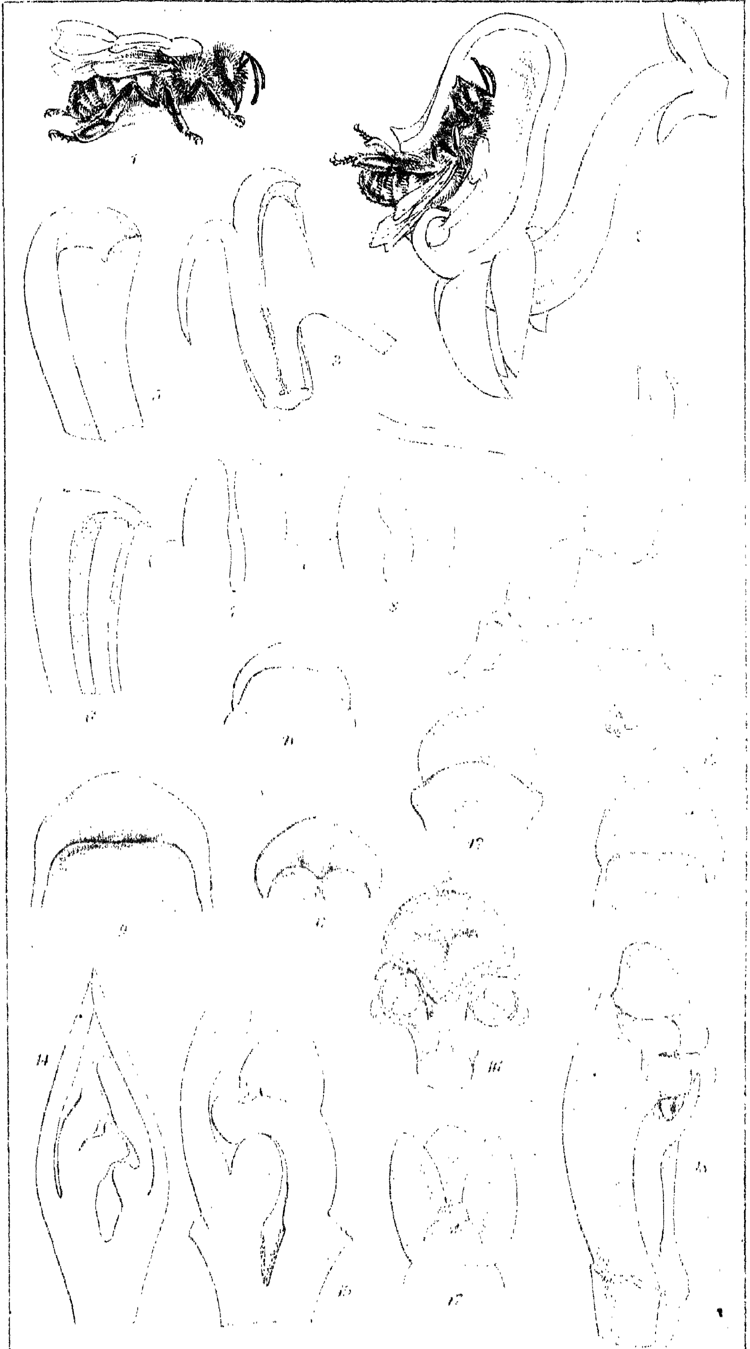
Fig. 5. Various threads in which a double cyst has been formed above, and a single cyst in one or more of the central articulations. In one a lateral cyst has been formed at the apex.

Fig. 6. An irregular cyst filled with spores formed by the junction of two threads.

Fig. 7. Mucorioid cysts, in one of which spores have been formed, while in two there are secondary cells. There is no columella as in *Mucor*.

Fig. 8. Spores germinating *in situ*.

All the figures are more or less magnified.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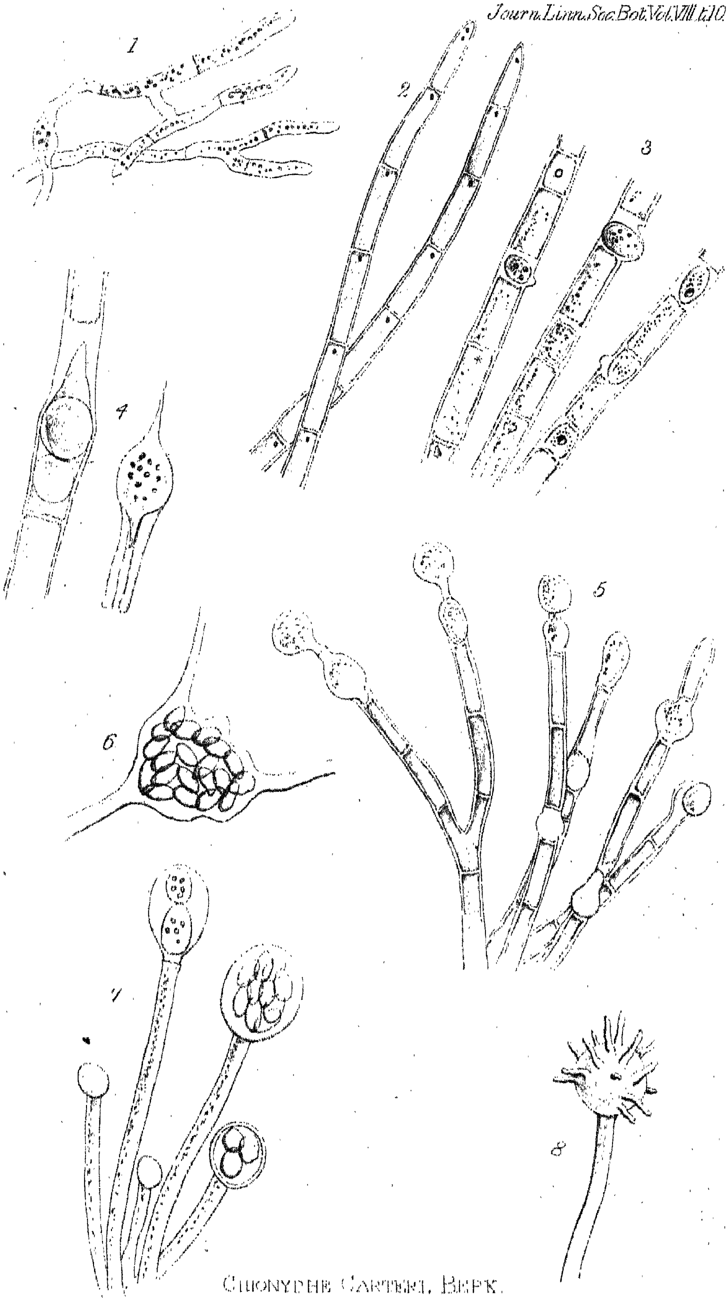
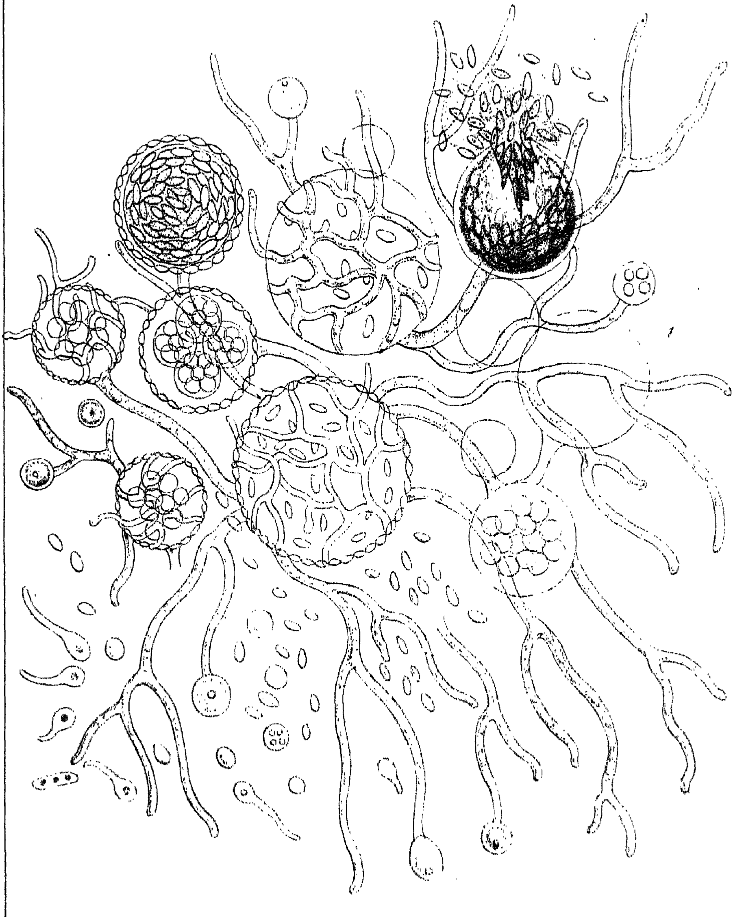
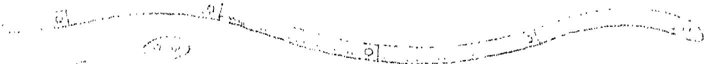


CHIONYPHE CARTERI, BERK.

G. Jarman sc





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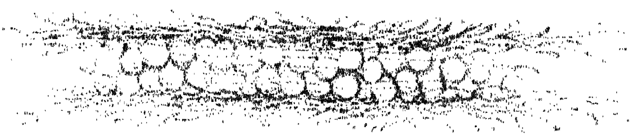

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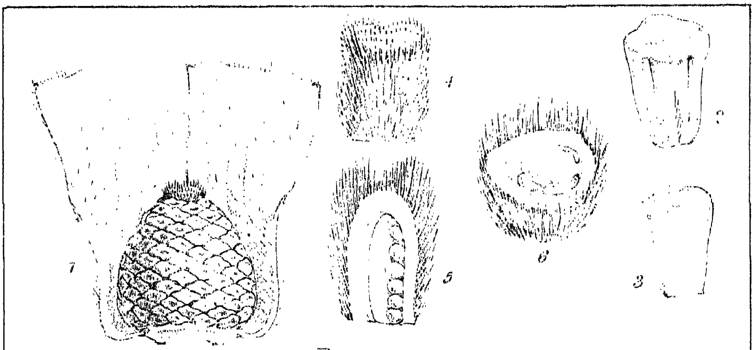
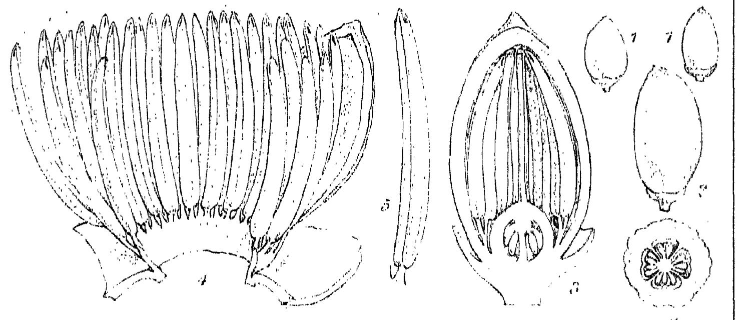
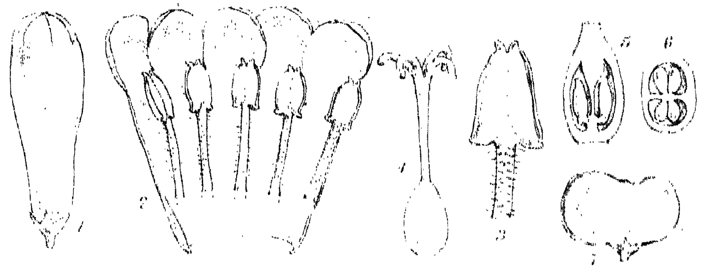


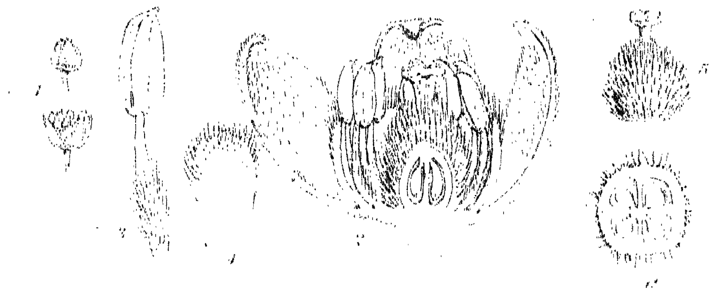
Piptostigma.

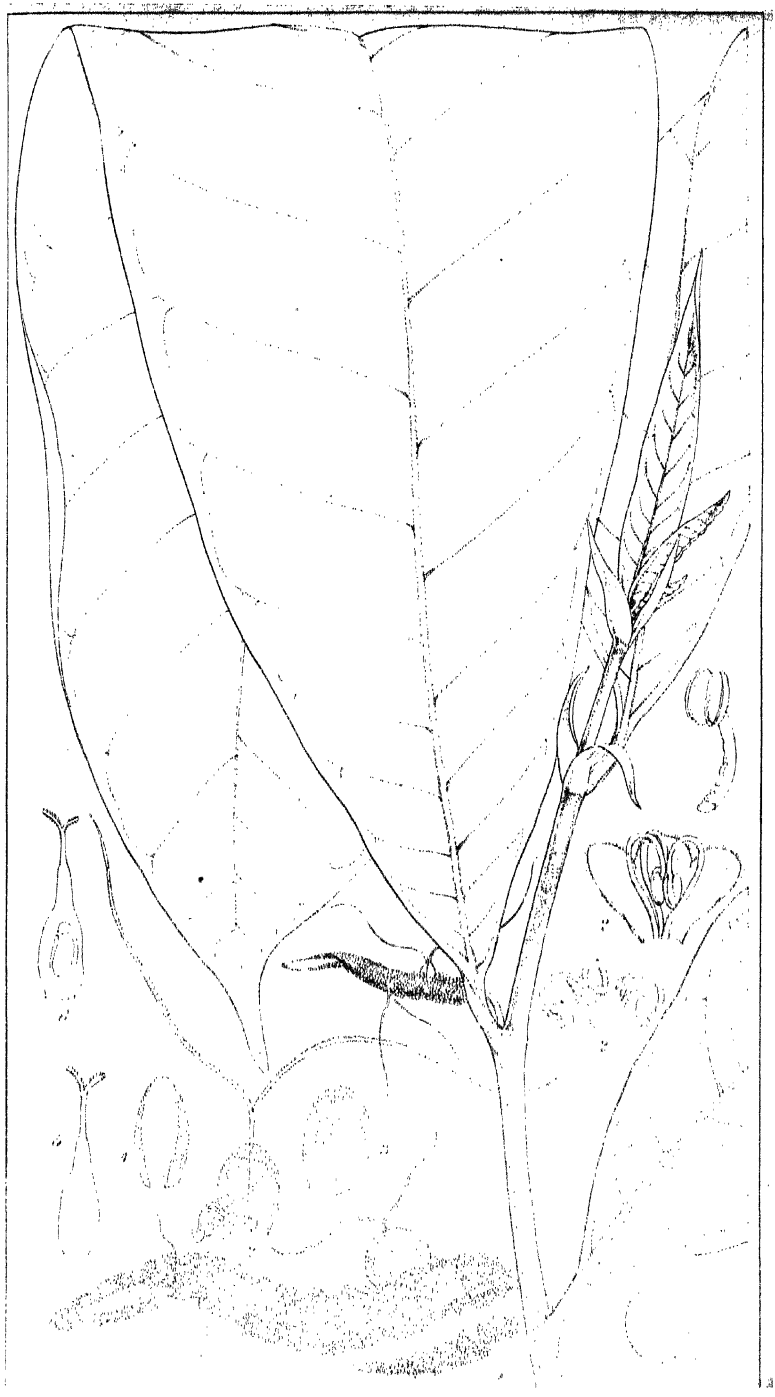


Rhaptopetalum.



Leptocladus.





## *Note to the above Paper, by the* SECRETARY.

[PLATE XI.]

Since the reading of Mr. Berkeley's paper, the Secretary has been favoured with a letter from Mr. H. J. Carter, enclosing tracings of his original drawings of *Chionyphe Carteri.* From these tracings the accompanying woodcut and the figures in Plate XI. have been made; and, with Mr. Carter's permission, the substance of the letter is here given, together with an explanation of the woodcut and Plate:—

"I send you the tracings of my drawings of the elements of the Fungus-disease of India, now called by Dr. H. Vandyke Carter '*Mycetoma*'; and also of the Red Fungus, which appears to be its free form, now called by Mr. Berkeley '*Chionyphe Carteri.*'

"The discovery of both forms is due to my friend and namesake Dr. H. Vandyke Carter, and all that I have added to his investigations (which are chiefly pathological) is a special examination of them for the purposes of natural history.

"In doing this, my object in the accompanying delineations has been to give elementary representations of *each* state of the fungus; not of what any single portion placed under the microscope would afford, but a combination of what is presented generally; so that the fungologist may be able at once to see all the different elements of which each form of the fungus is composed.

"Dr. H. Vandyke Carter's papers are to be found in the 'Transactions of the Medical and Physical Society of Bombay,'—

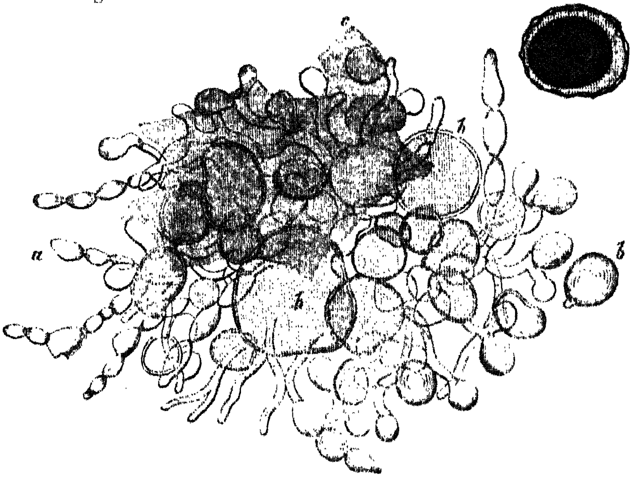
No. 6 (new series), p. 104, 1861.
No. 7 (new series), p. 206, 1862.
No. 8 (new series), Appendix, p. xxvi, 1863.

In the latter, Dr. Carter states that he has found the 'red mould,' i. e. *Chionyphe Carteri*, growing directly from the 'fungus-particles' of *Mycetoma.*

"The little I have written on the subject may be found in the same journal (No. 7, Appendix, p. i, 1862); also in the Ann. and Mag. of Nat. Hist. vol. ix. p. 442 (June 1862), and at p. 445, *foot-note,* is my diagnosis of the fungus of *Mycetoma*; while in the 'Intellectual Observer' for November 1862, p. 248, will be found Mr. Berkeley's observations on the subject, wherein he calls the 'red mould' *Chionyphe Carteri.*

"It was from seeing the drawing of *Chionyphe*, with these observations, that I came to the conclusion that the plant had not grown so vigorously with my kind friend Mr. Berkeley (from the dry rice-paste including its spores that I brought home from India) as in its native country, and therefore offer you (for the Society) tracings of my drawings of it as it appears under more favourable circumstances, and thus better developed."

Fig. 1. Fig. 2.



## EXPLANATION OF WOODCUT.

Fig. 1. A combination of the elementary parts of *Mycetoma*, on the scale of $\frac{1}{12}$th to $\frac{1}{5400}$th of an inch, showing—*a*, filaments; *b b b*, large cells growing on the ends of the filaments (abortive sporangia?); *c*, shade, showing flakes of concretionary brown matter, originally derived from the bursting of the abortive sporangia (?), which, in aggregation, thus gives the dark "vandyke-brown" colour to the general mass of *Mycetoma*. The natural tint, when minute portions are torn to pieces for microscopical examination, is light brown. See my descriptions of all this in the 'Annals,' *loc. cit.* The drawing was made from portions of *Mycetoma* taken from a foot *only half an hour* after it was amputated.

Fig. 2 represents one of the large cells, or abortive sporangia, acted upon by a solution of iodine in iodide of potassium, under which its contents indicate, by their tint, a strong admixture of starch.

## EXPLANATION OF PLATE XI.

Fig. 1. A combination of the elementary parts of *Chionyphe Carteri.* Some o the filaments are red; others present only the yellow or opalescent tints of the oleaginous or albuminous globules which they contain. The same is the case with the sporangia and the sporidia as to colour. The cell-wall of the sporangia presents a wavy appearance, probably

from wrinkling. The sporangia also show the formation of the sporidia in different stages, that is, the resolution of their contents into sporidia. One has burst, and shows the suspending mucilage of the cell to be coloured, as well as that of the contents of the sporidia. They are, for the most part, covered with a network of smaller filaments, which seem to spring from the same filament on which the sporangium is borne. What the office of this may be I cannot say, unless it be connected with impregnation, after the manner pointed out by Pringsheim in *Saprolegnia*, &c. The drawing also shows sporidia in process of germination. The whole on the scale of $\frac{1}{12}$th to $\frac{1}{5400}$th of an inch, *i.e.* on the same scale as that of *Mycetoma*.

Largest sporangium $\frac{13}{5400}$ diam.; sporidium $\frac{1}{5400}$ long, oval, acuminate; filament $\frac{1}{5400}$ across, in long cells, with the nucleus at the upper end. See fig. 2.

Fig. 2. Filament, more magnified.

Fig. 3. Sporidia, more magnified.

Fig. 4. Greatly magnified view of the layer of *Chionyphe Carteri*, as it grows over the surface of the water in the glasses containing portions of the foot affected with *Mycetoma*, after the latter have been placed aside for maceration. Vertical section, showing—*a*, the upper layer of filaments; *b*, the middle layer, where the sporangia are chiefly formed; and *c*, the lower layer, composed chiefly of its mycelium.

I could not get the *Chionyphe* to grow on paste after the spring and beginning of summer, and therefore infer that this is the time at which it fructifies, which it did at first vigorously on the rice-paste; in June the formation of spores began to cease, and shortly afterwards all the spores were discharged, and, together with the ruptured membranes of the sporangia, were found scattered throughout the remaining filamentous mass.

## On the Identity of *Pinus Peuce*, Griseb., of Macedonia, with the *P. excelsa* of the Himalaya Mountains. By J. D. Hooker, M.D., V.P.R.S. & L.S.

[Read March 3, 1864.]

In 1839 Dr. Grisebach, now the eminent Professor of Botany in Göttingen, but then travelling on a scientific mission in Rumelia and the neighbouring countries, discovered a small forest of a very peculiar-looking five-leaved Pine, evidently new to Europe. The locality (a very confined one) was on Mount Peristeri, above Bitolia, in Southern Scardus (an eastern district of Macedonia bordering on Dalmatia), lat. 41° N., long. 21° E. There this Pine forms an interrupted wood of distant trees, growing in a granite soil, between the elevations of 2400 and 5800 feet (German), amongst a dense undergrowth of Oxycedrus and Juniper; only young cones were found (in July). The height of the tree varies from 40 feet at its lowest altitude to a tortuous bush 4 feet high at its uppermost.

In Dr. Grisebach's narrative of his journey this Pine was regarded as a variety of *P. Cembra*, the only other five-leaved Pine of Europe; but in his excellent 'Spicilegium Floræ Rumelicæ et Bithynicæ' (ii. 350) it is described as a new species, intermediate between *P. Strobus* and *P. Cembra.* Unfortunately in that work the seed is stated in the diagnosis not to be winged, and, in the detailed description, to be surrounded with a narrow wing only, instead of having the large broad wing of *P. excelsa* and *P. Strobus.* This observation seems to have misled all succeeding botanists, as Endlicher, Loudon, Gordon, &c., who have all referred *P. Peuce* to the *Cembra* group.

Nothing further seems to have been known of this plant for a quarter of a century, indeed till the other day, when Messrs. Haage and Schmidt, of Erfurt, sent to Sir W. Hooker branches with ripe cones, gathered in the forest that Dr. Grisebach discovered, by M. Orphanides, late Curator of the Royal Gardens at Athens. These, on being received at Kew, were at once recognized as being identical with either *P. excelsa* of India or *P. Strobus* of America, and inquiries were instantly made of Messrs. Haage and Schmidt as to the authority for the habitat, &c. Every confirmation was at once supplied, and Dr. Grisebach, who has since been communicated with, has also expressed his opinion of the genuineness of the rediscovery. Messrs. Haage and Schmidt also, at our suggestion, compared the specimens and seeds with those of *P. excelsa*, and pronounced them identical with the latter.

It only remains to observe, that we have again carefully examined *P. Peuce*, and failed to find any difference between the Indian and Macedonian plants. The former is one of the best-known Himalayan trees, extending throughout the whole range of the Himalaya, from Assam to Afghanistan (the small province of Sikkim alone excepted), at elevations of from 4000–8000 feet. In the more humid eastern districts its leaves are longer and more flaccid; in the drier western, shorter, and altogether similar to those of *P. Peuce.* It has been found nowhere between Macedonia (long. 21° E.) and Afghanistan (long. 70° E.), an extent of upwards of 2200 miles.

It is not my purpose to enter into any discussion upon the many curious reflections to which this interesting discovery must give rise, of which the most noticeable are, that no record of a plant so conspicuous, and so widely different from any known

European Conifer, should exist in the writings of the Greeks, and that it should not have attracted the attention of any other modern traveller than the distinguished botanist to whom we owe its discovery in Europe.

Further, the bearing of this fact in geographical distribution upon our modern speculations as to the origin and migration of existing species is indeed most suggestive; and that a plant so well marked should have disappeared over an area of 2200 miles, and yet retained its characters apparently unaltered during the ages that have elapsed in the interval represented by this extinction, and regardless of the vast geographical and climatal changes that must have determined its present limitation, is one of the most interesting problems that has ever been unfolded to us by the history of any European tree.

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## Dimorphism in the Flowers of *Monochoria vaginalis*. By JOHN KIRK, M.D. Communicated by the President.

[Read April 7, 1864.]

THIS plant is found in the shallow lagoons of the Zambesi, and in mode of flowering presents two very distinct forms. The usual inflorescence is a spike 3–4 inches long, with a membranous spathe at base, arising from the sheathing petiole of the leaf. At the time of flowering this is raised above the surface, again descending to mature its fruit.

The second form of inflorescence consists of a solitary, almost sessile flower, produced at the base of the leaf-stalk, and included in its sheath. This is never raised above the surface of the water. In addition, each flower is protected by a short sac, formed of the membranous spathe, without any opening or fissure; within this flowering and fecundation go on; nor is it until after the capsule has become enlarged that this sac is ruptured.

The perianth consists of a single three-toothed ring, having on the inner surface of one of its segments a solitary stamen, two-celled, and opening by longitudinal valves. The ovary presents no difference, but resembles that of the normal flower; the style, however, is almost obsolete; the three stigmatic surfaces almost sessile at the apex of the ovary, and directed to one side. No marked difference is to be observed between the ripe capsules;

both contain many perfect seeds; but the solitary or abnormal form seems to be commonly rather larger.

The Hookerian Herbarium contains specimens of the plant from various parts of tropical Africa, and all present the double type of flowering, which is not so obvious in those of India and Australia.

## On some Species of *Musci* and *Hepaticæ*, additional to the Floras of Japan and the coast of China. By WILLIAM MITTEN, A.L.S.

[Read April 21, 1864.]

THE first list of the species of Musci from Japan and the adjacent islands was published in 1859, in the 'Proceedings of the American Academy,' by Messrs. Sullivant and Lesquereux, from the collections made during the American Exploring Expedition under the command of Captain Rodgers; seventy-eight species in all were enumerated, of which twenty-four were considered new, and the remainder referred to known European and North American forms. In the collection made in 1861 by Mr. Oldham, and now in the Herbarium of Sir W. J. Hooker, the proportion of European forms is much less, and is represented rather by cosmopolitan species than by any referable to particular areas, and it would appear that the Musci of Japan consist of a mixture of the forms of northern temperate regions with others principally tropical, and these corresponding very nearly with those of the Indian Archipelago, whence it is probable that a very large number of species will be found to inhabit the islands included in Japan.

### MUSCI.

#### DICRANACEÆ, *Mitten.*

#### DIDYMODON, *Hook.*

D. CRISPIFOLIUS, sp. nov. Monoicus, cæspitosus, caule parce ramoso, foliis e basi erectiore subrotundata subulatis longe lineari-lanceolatis patenti-incurvis siccitate laxe crispatis, nervo percurrente apice dorso pauci-denticulato, marginibus e medio ad apicem remote serrulatis, cellulis basi ad angulos oblongis hyalinis inde cito in minutas rotundatas luteas papillosas transeuntibus, perichætialibus basi magis convolutis, theca in pedunculo gracili pallido luteo inclinata obovata curvata lævi basi strumosa, ore magno, operculo conico curvirostrato, calyptra capsulæ ⅔ obtegente, peristomio dentibus validis rubris dicranis, flore masculo gemmiformi compresso in foliorum infra perichætium axillis insidente.

*Hab.* Nagasaki, Japan, *Oldham.*

About one inch high. Whole plant pale yellowish green, becoming in the older parts fulvous. Allied to *D. polycarpus* (Ehrh.) and *D. strumifer* (W. et M.), but a little more robust and with more spreading leaves.

Belonging to this group, and enumerated by Sullivant and Lesquereux, are—

*Cynodontium pallidum* (Schreb.), of which a single stem was found loose amongst Mr. Oldham's specimens, and very fine specimens were gathered by Mr. Fortune in the province of Chekiang.

*Pleuridium subulatum*, Brid. A single stem intermixed with Mr. Fortune's specimens above named.

A species of *Campylopus*, very near to, if not identical with, the *C. nigrescens* of India, was gathered by Mr. Oldham on rocks at Nagasaki in a barren state, and several species in the same imperfect condition have been received from Hongkong.

## LEUCOBRYACEÆ, *C. Müller.*

### SCHISTOMITRIUM, *Dzy. et Molk.*

S. **GARDNERIANUM**, *Mitten.*

*Hab.* On pine-trees, Nagasaki, Japan, *Oldham.*

The specimens are barren, but appear to belong to this species.

## GRIMMIACEÆ, *Mitten.*

### GLYPHOMITRIUM, *Brid.*

G. **DENTATUM**, sp. nov. Laxe cæspitosum, caule procumbente parce ramoso, foliis patulis e basi elliptica lanceolatis obtusiusculis acutatis, nervo sub summo apice evanido, margine e medio ad apicem remotiuscule dentato, cellulis basi infima paucis parallelogrammaticis mox in quadratas superne in minutas rotundatas distinctas transeuntibus, perichætialibus conformibus, theca in pedunculo brevi ovali aurantiaca, operculo subulato, peristomio e dentibus brevibus rubris integris divisisve, calyptra thecam ad medium tegente.

*Hab.* Nagasaki, Japan, on rocks, *Oldham.* Sam-Sa Bay, China, *Alexander.*

Near to *G. lepidomitrium*, C. Müller, from Mexico, but the leaves are wider above.

G. **SINENSE**, sp. nov. Compacte pulvinatum, caule simplici, foliis patentibus incurvis e basi ovali lanceolatis, nervo crassiusculo in apice evanido, marginibus superne incurvis integerrimis, cellulis basi ob-

longis mox in quadratas superne minutas rotundatas subobscuras transeuntibus, perichætialibus conformibus, theca in pedunculo elongato rubro cylindrica pallide fusca, operculo subulato pallido, peristomio dentibus brevissimis flavis punctulatis, annulo composito, calyptra thecam ad basin obtegente eamque amplectente.

*Hab.* Japan, *Oldham.* China, Nan-kong-foo, by the cataract Kiang-si, *Alexander.*

In compact roundish tufts of a blackish-green colour. In its stems and foliage similar to *G. crispatum*, Hook., but the leaves more acute, and the capsule on a longer seta, which gives the plant at first sight more the appearance of a *Tortula.*

A very few stems, belonging to all appearance to *Grimmia apocarpa*, L., were intermixed with *Stereodon Oldhami.*

## ORTHOTRICHACEÆ, *Mitten.*

### MACROMITRIUM, *Brid.*

**M. RUPESTRE**, sp. nov. Dioicum, caule prostrato repenti fusco radiculoso ramis brevibus densifoliis late cæspitoso, foliis rameis humidis patentibus apicibus incurvis, siccitate incurvatis contortis ligulato-lanceolatis, inferioribus apice obtusis subcucullatis acutatisve, superioribus acutis, nervo percurrente carinatis, marginibus integerrimis, cellulis inferioribus parvis oblongis pellucidis, uno latere in basi infima ad nervum paucis majoribus hyalinis, superioribus parvis rotundatis obscuris, perichætialibus dimidio brevioribus erectis, theca in pedunculo elongato gracili pallide aurantiaca ovali versus os intensiore colorata plicata gymnostoma, operculo e basi convexo subulato, calyptra nuda thecam ad medium tegente.

*Hab.* Rocks at Nagasaki, Japan, *Oldham.*

Growing in extensive patches; the younger leaves yellowish, the older brown; the calyptra is small, and more deeply split on one side. A more slender species than *M. spathulare*, Mitten, from Hongkong, which has, too, a shorter seta and pilose calyptra.

## BARTRAMIACEÆ, *Mitten.*

### BARTRAMIA, *Hedw.*

**B. POMIFORMIS**, *L.*

*Hab.* Nagasaki, Japan, *Oldham.*

### PHILONOTIS, *Brid.*

**P. PALUSTRIS**, sp. nov. Monoica, cæspitosa, caule elongato inferne radiculoso tomentoso, foliis subsecundis lanceolatis, nervo breviter excurrente, marginibus serrulatis, cellulis elongatis pellucidis papillosis interstitiis teneris basi paucis brevioribus, foliis rameis carinatis, perichætialibus e basi latiore ovata subulato-lanceolatis, theca in pedunculo elongato rubro globosa horizontali plicata, operculo conico-convexo, peristomio normali?, flore masculo perichætio proxima.

*Hab.* In a marsh in the hills, Pi-quan Island, China, *Alexander*.

Very similar to *P. radicalis* (Beauv.), but the leaf is wider and more laxly areolate, the nerve not denticulate on the back. The male flower has not been seen.

P. LANCIFOLIA, sp. nov. Dioica, cæspitosa, caule elongato, foliis erecto-patentibus subsecundisve anguste elliptico-lanceolatis sensim tenuiter acuminatis, nervo excurrente, marginibus revolutis serrulatis, cellulis elongatis papillosis basi paucis subquadratis, perichætialibus internis ovato-lanceolatis subplicatis integerrimis, externis e basi latiore sensim subulato-lanceolatis, theca in pedunculo elongato rubro globosa plicata inclinata, peristomio normali?, dentibus parvis luteis brevibus.

*Hab.* Rocks at Nagasaki, Japan, *Oldham*.

Glaucous green. In size similar to small forms of *P. fontana* (L.), and allied to *P. mollis*, Dzy. et Molk., but differing in its more elliptical leaf, the widest part being about the middle.

P. SOCIA, sp. nov. Dioica, laxe cæspitosa, caule brevi, foliis erecto-patentibus subsecundis anguste ovato-lanceolatis, marginibus recurvis serrulatis, nervo excurrente, cellulis elongatis angustis basi abbreviatis parvis quadratis, perichætialibus e basi ovata longe subulatis, theca in pedunculo elongato rubro globosa inclinata plicata, operculo conico, peristomio dentibus brevibus rubris, interno processibus ¼ brevioribus punctulatis, ciliis singulis brevibus interpositis.

*Hab.* Nagasaki, Japan, *Oldham*.

Pale green. Similar to *P. Muhlenbergii* (Schw.), but with shorter leaves.

## BRYACEÆ, *Mitten.*

### BRYUM, *Dill.*

B. SCABRIDENS, sp. nov. Dioicum, caule brevi, foliis erecto-patentibus lanceolatis acutis, nervo percurrente, marginibus apicem versus serrulatis, cellulis elongatis angustis, perichætialibus subulato-lanceolatis marginibus recurvis, theca in pedunculo prælongo rubro elliptico ovali horizontali, operculo conico acuminato brevirostrato, peristomio dentibus e medio ad apicem rugulosis punctatis, interno processibus angustis perforatis rugulosis punctatis, in membrana ad tertiam partem longitudinis dentium exserta, annulo composito.

*Hab.* On damp ground in shady places, Nagasaki, Japan, *Oldham*.

Closely resembling *B. flexuosum* (Harvey). Improperly referred to *Webera* in the 'Musci Indici.'

B. CAPILLARE, *Hedw.*
*Hab.* Rocks, Nagasaki, Japan, and on the City wall, Ningpo, China, *Oldham.*

## MNIACEÆ, *Mitten.*

### FISSIDENS, *Hedw.*

F. JAPONICUS, *Dzy. et Molk.*
*Hab.* Nagasaki, Japan, *Oldham.*

A few fragments only, picked out from *Marchantia nitida.*

F. ADIANTOIDES, *L.*
*Hab.* Hongkong, *Bowring*; Sam-Sa Bay, *Alexander.*

F. ZIPPELIANUS, *Dzy. et Molk.*
*Hab.* Hongkong, *Bowring.*

### MNIUM, *Dill.*

M. RADIATUM, *Wils.* M. flagellare, *Sullivant et Lesquereux.*
*Hab.* Nagasaki, Japan, *Oldham.*

Allied to *M. Menziesii*, Hook.

M. ROSTRATUM, *Hedw.*
*Hab.* Nagasaki, Japan, *Oldham.*

M. INTEGRUM, *Dzy. et Molk.*
*Hab.* In running streams, Nagasaki, Japan, *Oldham.*

### ANACAMPTODON, *Brid.*

A. FORTUNEI, sp. nov. Caule repenti vage ramoso intertexto, foliis patentibus ovato-lanceolatis sensim acutis, nervo crassiusculo excurrente, marginibus incurvis, cellulis brevibus oblongis, perichætialibus erectis convolutis ovali-lanceolatis, nervo tenui ultra medium evanido. theca in pedunculo semiunciali ovali siccitate sub ore constricta, operculo convexo rostrato, peristomio externo dentibus lanceolatis obtusis teneris dorso convexis, interno ciliis angustis dimidio brevioribus.
*Hab.* On oaks in woods, Province of Chekiang, China, *Fortune.*

Closely resembling *A. splachnoides*, Brid., and agreeing with it entirely in its capsule and peristome; but the operculum with its slender beak is different, and the leaves are narrower and have the nerve distinctly excurrent, the apex of the leaf being composed of it solely.

## HYPNACEÆ, *Mitten.*

### HYPNUM, *Dill.*

### (*Rhynchostegium*, Schimp.)

H. INCLINATUM, sp. nov. Monoicum, caule procumbente ramis confertis cæspitosis, foliis subcompressis patentibus ovato-lanceolatis

acutis, nervo ad $\frac{3}{4}$ evanido, marginibus basi recurvis inde ad apicem serratis, cellulis elongatis angustis, perichætialibus e basi late ovali subulatis serrulatis brevinervatis, theca in pedunculo elongato lævi ovali inclinata, in collum sensim attenuata, operculo conico curvirostrato, peristomio interno processibus ciliis binis in unum conflatis subæquilongis, in membrana fere ad medium dentium longitudinis exserta.

*Hab.* Moist banks, Ohosima, Japan, *Oldham*, Oct. 1861.

Dull brownish green. In size and habit agreeing with *H. confertum*, Dicks., but more nearly allied to *H. rhaphidorrhynchum*, C. Müller, and, excepting that its seta is smooth, to *H. speciosum*, Wils. In the inclined capsule it resembles *H. murale*, Hedw., which has its fruit sometimes nearly erect.

H. PALLIDIFOLIUM, sp. nov. Monoicum, caule procumbente ramis laxis laxe cæspitosis, foliis compressis ovato-lanceolatis acuminatis, nervo ad $\frac{2}{3}$ evanido, marginibus serrulatis, cellulis elongatis angustis, perichætialibus e basi ovali subulatis integerrimis nervatis, theca in pedunculo gracili rubro horizontali ovali-cylindracea inæquali, peristomio interno processibus ciliis binis æquilongis trabeculatis in membrana ad tertiam partem dentium longitudinis exserta.

*Hab.* Nagasaki, Japan, *Oldham.*

Glossy pale green. Foliage much compressed, unaltered when dry; leaves less rigid than in *H. inclinatum* and more acuminate; perichætial leaves entire; capsule horizontal or drooping, and internal peristome different. It has somewhat the appearance of some states of *H. tenuifolium*, Hedw., but the leaves are more acuminated.

### STEREODON, *Brid.*

(*Ctenidium*, Schimp.)

S. HASTILIS, sp. nov. Dioicus, cæspitosus, caule procumbente pinnato, foliis squarrosis e basi lata cordata subæquilatero-triangulari lanceolato-subulatis tenuiter acuminatis, foliis rameis lanceolatis, nervis obsoletis, marginibus serrulatis, cellulis omnibus elongatis angustis lævibus, perichætialibus erectis lanceolato-subulatis serrulatis, theca in pedunculo elongato rubro crassiusculo ovali, operculo conico, calyptra ramentis elongatis pluribus obtecta.

*Hab.* Nagasaki, Japan, *Oldham.*

In habit and appearance nearly allied to the *S. lichnites*, Mitten, of India, and to *S. pilosus*, Hook. f. et Wils., of New Zealand, but distinct in its leaves being attenuated from a wide triangular base. The calyptra is more pilose than in any species yet included in the small group of which *S. molluscus* (Hedw.) is the European form. The capsules are all too young, but appear to be arcuate.

(*Ctenium*, Schimp.)

S. **Oldhami**, sp. nov. Dioicus, dense intricato-cæspitosus, caule procumbente ramulis densis brevibus pinnato, foliis falcatis secundis lanceolatis e basi subovata sensim tenuiter angustatis superne serrulatis, nervis binis brevibus, cellulis omnibus elongatis angustis, perichætialibus internis ovatis subplicatis apice subulatis, theca in pedunculo elongato rubro ovali inæquali horizontali, operculo conico acuto, peristomio normali processibus solidis ciliis binis interpositis.

*Hab.* Rocks at Nagasaki, Japan, *Oldham.*

At first sight this moss has a striking resemblance to the smaller tufted states of *S. molluscus*, having the same soft yellowish appearance and similar ramification, but its affinity would seem to be with *S. plumæformis*, Wils., and *S. crista-castrensis* (L.).

S. **plumæformis** (*Wils.*).
*Hab.* Rocks, Nagasaki, Japan, *Oldham.*

The description of *Hypnum Rodgersianum*, Sullivant and Lesquereux, appears to indicate this fine species.

## LEUCODONTACEÆ, *Mitten.*

### Hedwigia, *Ehrh.*

H. **ciliata**, *Dicks.*
*Hab.* Rocks, Nagasaki, Japan, *Oldham.*

## LESKEACEÆ, *Mitten.*

### Anomodon, *Hook.*

A. **tristis**, *Cesati.*
*Hab.* Nagasaki, Japan, *Oldham.*

A. **devolutus**, *Mitten.*
*Hab.* City wall, Ningpo, China, *Oldham*; Hongkong, *Bowring.*

A. **viticulosus**, *L.*
*Hab.* City wall, Ningpo, China, *Oldham.*

### Leskea, *Hedw.*

L. **decurvata**, sp. nov. Dioica, caule procumbente cæspitoso, ramis inordinatis ramosis apicibus secundifoliis decurvis, foliis imbricatis patentibus late ovatis acutis, nervo concolori percurrente, marginibus minute crenulatis, cellulis omnibus parvis ovoideo-rotundis distinctis subpellucidis minute papillosis, perichætialibus erectis ovato-lanceolatis sensim angustatis apice serrulatis, cellulis elongatis areolatis, theca in pedunculo elongato rubro cylindracea arcuata, operculo conico acuminato.

*Hab.* Rocks, Nagasaki, Japan, *Oldham.*

Habit, colour, and appearance altogether that of *L. polycarpa*, Ehrh.; but the areolation of the leaves is more dense, the cells being about half the size of those in that species, and the capsule, so far as can be seen from the unripe fruit on the specimens, is arcuate.

## NECKERACEÆ, *Mitten.*

### OMALIA, *Brid.*

O. NITIDULA, sp. nov. Caule humili, foliis compressis patentibus obovatis apice obtusis crenulatis angulo parvo terminatis, nervo tenui concolori medio evanido, cellulis apice ad marginemque lateris superioris ovoideis, reliquis e folii medio ad basin usque laterisque inferioris elongatis, omnibus pellucidis.

*Hab.* Nagasaki, Japan, *Oldham.*

Similar in size to *O. trichomanoides* (Schreb.), but with wider obovate leaves.

### THAMNIUM, *Schimp.*

T. SUBSERIATUM (Neckera), *Dzy. et Molk.*

*Hab.* Nagasaki, Japan, *Oldham.* Moist places among rocks, Buffalo Bay, China, *Alexander.*

## RHACOPILACEÆ, *Mitten.*

### RHACOPILUM, *Brid.*

R. ARISTATUM, sp. nov. Caule repenti pinnatim ramoso radiculoso, foliis rigidulis statu sicco directione immutatis, lateralibus divergentibus ovali-oblongis acutis, nervo concolori in pilum viridem lævem excurrente, marginibus superne serrulatis, cellulis ovoideo-rotundatis, superioribus subhexagonis, foliis superioribus dimidio minoribus ovato-subulatis.

*Hab.* Yokahama, *Oldham.*

Intermediate in size between *R. spectabile*, Hsch., and *R. tomentosum*, Sw., with the foliage when dry retaining the same direction as when wet, but having the margins of the leaves involute.

## HYPOPTERYGIACEÆ.

### HYPOPTERIGIUM, *Brid.*

H. JAPONICUM, sp. nov. Synoicum, stipite brevi, foliis deltoideo-ovatis, superne in frondem parvam subdeltoideam ramosam, foliis parum asymmetricis ovatis, acumine brevi terminatis, limbo tenui pallido apicem versus denticulato circumductis, nervo infra apicem evanido, cellulis parvis ovoideo-rotundis, apice rotundis limitibus mollibus, foliis stipuliformibus suborbiculatis, acumine brevi subulato, nervo percurrente, in rameis interdum sub apice evanido, perichætialibus parvis ovatis acuminatis, theca in pedunculo pallide fusco apice sublævi ovali elliptica in collum sensim angustata, peristomio normali.

*Hab.* Nagasaki, Japan, *Oldham.*

In size, colour, and appearance very closely resembling *H. Tibetanum*, Mitten, Musci Ind. Or.; but it differs from that species in its more regularly ovate leaves with longer nerves, and cells only half as large; the form of the capsule appears also to be different, it having with the thickened neck an elliptical outline, and when dry it is very much shrivelled up. The capsule of *H. Tibetanum* is more ventricose at the base and somewhat ovate in its form, not gradually attenuated into the neck, and retains the same form when dry.

## POLYTRICHACEÆ, *Mitten.*

### POGONATUM, *Brid.*

P. **SPINULOSUM**, sp. nov. Caule brevissimo, foliis e basi erectiore latiore subulatis breviter oblongo-lanceolatis incurvis, nervo crassiusculo percurrente superne dorso dentibus cristato, marginibus e basi ad apicem dense spinuloso-dentatis, perichætialibus erectis elongatis convolutis oblongo-lanceolatis acutis apice marginibus dorsoque denticulatis, theca in pedunculo elongato subcylindracea inæquali suberecta inclinatave, operculo convexo breviter curvirostrato, calyptra tomentosa thecam totam obtegente.

*Hab.* On the earth, Nagasaki, Japan, *Oldham.*

Nearest to *P. Gardneri*, C. Müller, but larger than Gardner's specimens, and differing from it and *P. Pennsylvanicum*, Hedw., in its perichætial leaves being more elongated, but with shorter points, and in the much more dentate lower leaves.

*P. aloides*, Hedw., has been gathered in Japan by Mr. Oldham, and in China by Mr. Fortune and Mr. Alexander.

## HEPATICÆ.

### SOLENOSTOMA, *Mitten.*

### *Plectocolea*, subgen. nov.

*Perianthium* terminale, tubulosum, plicatum, ore denticulatum. *Caulis* ascendens. *Folia* explanata, disticha, pagina inferiore radicellis villosa. *Amphigastria* parva obsoletave.

S. **RADICELLOSUM**, sp. nov. Caule procumbente subsimplici crassiusculo, radicellis pallidis foliis adhærentibus, foliis subverticalibus suborbiculatis oblatisve patulis concavis, margine ventrali recurvis, dorsali decurrente, cellulis rotundatis, interstitiis teneris, marginalibus paululo majoribus subquadratis, involucralibus conformibus liberis parum majoribus, perianthio ovato pluries plicato, ore parvo truncato crenulato.

*Hab.* On moist earth, amongst *Marchantia nitida*, Nagasaki, Japan, *Oldham.*

This species agrees very nearly with *Jungermannia polyrhiza*, Hook., and forms with it and a few other Indian species a small group, remarkable for their plicate perianths and for the presence of root-like filaments on the underside of the leaves.

### TRIGONANTHUS, *Spruce.*

T. DENTATUS (*Raddi*).

*Hab.* On earth, amongst the stems of *Pogonatum spinulosum*, Nagasaki, *Oldham.*

A few very small stems.

### CHILOSCYPHUS, *Corda.*

C. ARGUTUS, *Nees ab E.*

*Hab.* Nagasaki, Japan, *Oldham.*

C. PLANUS, sp. nov. Caule procumbente vage ramoso subsimplicive, foliis explanatis subconvexis ovato-quadratis apice rotundatis, uni- vel sæpius truncato-bidentatis, rarius tridentatis, cellulis hexagonis chlorophyllosis, amphigastriis parvis discretis bifidis laciniis extus unidentatis.

*Hab.* Nagasaki, Japan, *Oldham.*

Very nearly resembling *C. argutus*, but with the leaves as in *C. Zippelianus*, Gottsche. They are, however, more rigid, and unaltered when dry.

### CALYPOGEIA, *Raddi.*

C. BIDENTULA, *Nees ab E.*

*Hab.* Intermixed with the preceding, *Oldham.*

### RADULA, *Nees ab E.*

R. PHYSOLOBA, *Mont.*

*Hab.* Rocks, Nagasaki, Japan, *Oldham.*

### LEJEUNIA, *Gottsche et Ldbg.*

L. SERPYLLIFOLIA, *Lib.*

*Hab.* Creeping amongst various mosses, Nagasaki, Japan, *Oldham.*

### PELLIA, *Raddi.*

P. CALYCINA, *Tayl.*

*Hab.* Nagasaki, Japan, *Oldham.*

### REBOULIA, *Raddi.*

R. HEMISPHÆRICA, *Raddi.*
*Hab.* Nagasaki, Japan, *Oldham.*

### MARCHANTIA, *L.*

M. NITIDA, *L. et L.*
*Hab.* Nagasaki, Japan, *Oldham.*

## On Four New Genera of Plants of Western Tropical Africa, belonging to the Natural Orders *Anonaceæ*, *Olacineæ*, *Loganiaceæ*, and *Thymelæaceæ*; and on a New Species of *Paropsia*. By Professor OLIVER, F.R.S., F.L.S.

[Read May 5, 1864.]

[PLATE XII.]

IN a small parcel of well-selected and well-dried plants, collected at Old Calabar by the Rev. W. C. Thomson, recently forwarded to the Herbarium of the Royal Gardens at Kew through the kindness of Professor Balfour, I find many undescribed species, some of which are referable to new generic types.

Of four new genera included amongst these, and also of a remarkably fine new *Paropsia*, I have now the honour to lay brief descriptions before the Linnean Society. I have drawn up these descriptions partly from Mr. Thomson's specimens and partly from specimens previously sent to Kew from the same country by Mr. Gustav Mann.

### PIPTOSTIGMA.

ANONACEARUM genus novum. Tribus *Mitrephoreæ*. Subtribus *Phæanthеæ*.

CHAR. GEN.—*Sepala* tria, libera, ovata v. lanceolata, acuta. *Petala* sex, libera, biseriatim valvata; exteriora sepaloidea, sepalis longiora; interiora multo majora, tenera, plana v. marginibus reflexis, circa genitalia erecto-conniventia. *Stamina* indefinita, supra torum hemisphæricum dense imbricata; antheris sessilibus, cuneato-oblongis, extrorsis, connectivo apice truncato transverse rhomboidali. *Carpella* 4–6, apice in stigma sessile capitatum depresso-globosum obscure lobatum pilosum deciduum coalita; ovulis 6–10 in sutura uni- v. biseriatis. *Fructus* ignotus.—Arbores. *Folia* subsessilia, subparallele penninervia. *Racemi* cymosi simplices v. paniculæ, ad ramos annotinos v. vetustiores nascentes.

Plate XII. fig. 1. Genitalia and connivent bases of two petals. 2 & 3. Anther, front and back. 4. Gynœcium. 5 & 6. Vertical and transverse sections of an ovary.

1. P. PILOSUM, sp. nov. Foliis obovato-oblongis breviter apiculatis basi subcordatis, membranaceis subtus parce pilosis, racemis elongatis simplicibus v. furcatis, bracteis lineari-lanceolatis pedicellis æquilongis v. longioribus, petalis exterioribus lineari-lanceolatis v. lanceolatis.—Ramuli pilis ferrugineis molliter tomentosis. Folia 10–14 poll. longa, supra medium 5½–6½ poll. lata, supra glabrescentia, subtus laxe pilosa, petiolo brevissimo nervoque medio sericeo-pilosis. Racemi (penduli?) 6 poll. ad 2 ped. longi, ferrugineo-pilosi, bracteis ½ poll. longis. Flores pedicellati bracteis sæpe oppositi. Sepala ovato-lanceolata acuta extus pilosa, lin. longa. Petala exteriora anguste lanceolata, 6–8 lin. longa, interiora fragilia multo majora, exunguiculata, basi circa genitalia concaviuscula, extus sericeo-pilosa, intus plus minus pubescentia v. sparse tomentella, ad 1½–2 poll. longa. Androecium globosum. Carpella 4–6 hirsuta, ovariis liberis, stigmatibus sessilibus, pilosis, coalitis; ovula circiter 8, uni- v. subbiseriata.
*Hab.* Old Calabar, *Rev. W. C. Thomson.*

Mr. Thomson describes the "calyx as externally light brown. Corolla very light pink, with deeper streaks.... Fruit of several united carpels; seeds in two rows, covered with a little pulp; bright scarlet."

2. P. GLABRESCENS, sp. nov. Foliis oblanceolato-oblongis breviter acuminatis, basi sæpius obtusis, glabris glabrescentibusve, paniculis cymose dichotomis, bracteis ovatis acutis, petalis exterioribus ovatis v. ovato-lanceolatis acutis.—Arbor 30-pedalis. Ramuli primum pilosi, annotini glabrescentes. Folia 4–8 poll. longa, supra medium 1½–2½ poll. lata, basin versus sæpius leviter angustiora, pagina superiore glabra, inferiore glabrescente v. sparse pilosula, nervo medio atque venis secundariis pilosis exceptis. Paniculæ dichotomæ ad 10–12 poll. longæ, ramulis ultimis ferrugineo-pilosis, bracteis parvis pedicellis sæpius brevioribus. Flores nutantes. Sepala triangulari-ovata, acuta, adpresse pilosa, intus glabriuscula. Petala exteriora quam sepala fere duplo longiora, interiora multo majora, ad ¾–1 poll. longa, ovato-lanceolata v. oblonga, acuta, utrinque tomentosa v. extus, basin versus, adpresse pilosa. Carpella 4; ovulis 6–10 biseriatis.
*Hab.* Kongui River, East Tropical Africa, *Mr. Gustav Mann*, August and September 1862.

### RHAPTOPETALUM.

### OLACINEARUM genus novum. Tribus *Olaceæ.*

CHAR. GEN.—*Calyx* parvus cupulatus, margine subinteger v. dentato-lobulatus, fructifer immutatus. *Petala* tria perigyna ad marginem disci inserta, coriacea, glabra, æstivatione valvata. *Stamina* indefinita (30–40), filamentis brevibus in tubum ad basin petalorum adnatum coalitis, antheris elongatis anguste linearibus erectis, apicem versus rima longitudinali breviter dehiscentibus. *Ovarium* in discum leviter immersum, semiinferum, quadriloculare, dissepimentis ad apicem attingentibus, stylo filiformi, stigmate minuto; ovula in quoque loculo ad 6, ab apice centrali pendula. *Fructus* ellipsoideus v. oblongus, pericarpio crustaceo v. subligneoso, unilocularis, monospermus. —Arbor glaberrima. *Folia* alterna integra coriacea. *Flores* pedicellati in fasciculos umbellulatos sæpius paucifloros dispositi.

Fig. 1. 1. Buds just before expansion, natural size. 2. Fruit. 3. Vertical section of flower. 4. Monadelphous stamens adnate to the petals. 5. Single stamen. 6. Transverse section of ovary.

1. R. CORIACEUM, sp. unica. Arbor 30-pedalis, ramulis teretibus lineis brevibus parum elevatis a basi foliorum decurrentibus utrinque notatis. Folia breviter petiolata elliptica v. ovato-elliptica, sæpe obtuse et breviter apiculata basi rotundata v. subacutata, utrinque glabra, 3½–5½ poll. longa, 1½–2¾ poll. lata, petiolus 1–3 lin. longus. Flores sæpe paulo supraaxillares, pedicellis gracilibus, alabastra 3–4 lin. longa, ovoideo-oblonga, subacuta. Fructus (indehiscens, an subdrupaceus ?) 9–10 lin. longus.

*Hab.* Fernando Po, *Mr. Gustav Mann,* 1862. Old Calabar, *Rev. W. C. Thomson,* who describes the corolla as pink and white.

## LEPTOCLADUS.

### LOGANIACEARUM genus novum.

CHAR. GEN.—*Calyx* persistens parvus 4–5-fidus. *Corolla* hypogyna, tubulari-infundibuliformis, limbi laciniis 4–5 brevibus, obtusis, æstivatione imbricatis. *Stamina* 4 v. 5 imo corollæ tubo inserta, inclusa; filamentis lineari-subulatis; antheris bilocularibus, loculis basi leviter divergentibus, longitudinaliter dehiscentibus. *Ovarium* biloculare; stylo filiformi; stigmate bifido, lobis bipartitis lineari-filiformibus, revolutis; ovulis in loculis geminatis adscendentibus collateralibus. *Fructus* (immaturus) coriaceus, compressus, late obcordatus v. bilobus, lobis subinæqualibus obtusis monospermis (an interdum dispermis ?). *Semina* compressa lateribus pilosulis margine glabris (an maturitate subalatis ?).—Frutex, ramulis strictis gracilibus. *Folia* opposita, integerrima, petiolata; stipulis interpetiolaribus minutis. *Flores* parvi in paniculas paucifloras axillares v. terminales dispositi; bracteolis obsoletis.

Fig. 1. Bud. 2. Corolla laid open. 3. Anther. 4. Pistil. 5, 6. Vertical and transverse sections of the ovary. 7. Fruit.

1. L. THOMSONI, sp. unica. Ramuli novelli puberuli. Folia lanceolata utrinque attenuata v. ovato-lanceolata, petiolata, obtusa v. obtusiuscula, minutissime mucronulata, glabra. Paniculæ gracile pedunculatæ, folio sæpe breviores v. interdum longiores.

Folia: lamina 8–15 lin. longa, 3–6 lin. lata, petiolo 1–1¼ lin. longo. Flores 2–3 lin. longi.

*Hab.* Old Calabar, *Rev. W. C. Thomson,* who states that the corolla is yellow with a white limb. When dry the corolla is reddish.

This interesting addition to the anomalous group of the Loganiaceæ presents, in the bifid lobes of the stigma, the same peculiarity in the Order as the genus *Gelsemium*, from which, however, it widely differs in its definite ovules and fruit.

Technically, I presume it must be, for the present, disposed under Mr. Bentham's tribe Gaertnereæ, characterized by solitary or geminate ovules. It is, however, very different in habit from any genus of this group known to me.

## OCTOLEPIS.

THYMELÆACEARUM genus novum.

CHAR. GEN.—*Perianthium* quadripartitum, loborum marginibus æstivatione imbricatis. Squamæ 8 per paria lobis perianthii oppositæ, integræ, æstivatione valvatæ. *Stamina* 8 fere hypogyna squamis alterna; filamentis liberis subulatis; antheris parvis ovatis v. ovato-cordatis, bilocularibus, longitudinaliter dehiscentibus. *Ovarium* superum, sessile, ovoideum, quadriloculare; stylo brevi, terminali; stigmate parvo, papilloso-dilatato; ovula in loculis solitaria pendula. *Fructus* ignotus.—Arbor parva. *Folia* alterna. *Flores* axillares, albi.

Fig. 1. Flower, natural size. 2. Vertical section of flower. 3. Stamen. 4. Scale. 5. Pistil. 6. Transverse section of an ovary.

1. O. CASEARIA, sp. unica. Frutex 6–8-pedalis. Ramuli juniores pubescentes v. puberuli, deinde glabrescentes. Folia breviter petiolata obovato-lanceolata, breviter acuminata v. apiculata, integra v. obscure repando-denticulata, membranacea, glabra, lamina 4½–9½ poll. longa, 2½–3¾ poll. lata, petiolus 1–3 lin. longus. Flores in fasciculos paucifloros (3–4) dispositi, pedicellis gracilibus 2–3 lin. longis. Alabastra ovata, pedicellis æquilonga v. breviora. Perianthium lobis oblongo-ovatis obtusis v. obtusiusculis, extus pubescentibus, intus puberulis. Squamæ quadrato-oblongæ marginibus intus apicemque versus pilosæ, basin prope perianthii insertæ. Stamina filamentis basi pilosis. Ovarium dense pilosum, stylus brevis.

*Hab.* River Kongui, *Mr. Gustav Mann*, September 1862 and February 1863; Old Calabar, *Rev. W. C. Thomson.*

*Octolepis* is so far removed in floral structure from any other Thymelæaceous genus with which I am acquainted, that I am at a loss to know what are its nearest affinities. With its quadripartite perianth, squamæ, and four-celled ovary, it does not consort well with any described Aquilarineæ. In *Geissoloma* and the Cape group of Penæaceæ we find an approach to the structure of the pistil of *Octolepis*, but their habit is extremely diverse, and their perianth is usually, if not always, more or less deeply tubular.

PAROPSIA GUINEENSIS, sp. nov. Ramulis ferrugineo-pubescentibus, foliis late ovalibus v. ellipticis, obtusiuscule acuminatis, repando-dentatis, breviter petiolatis, primum præcipue ad venulas pilosulis, denique supra glabrescentibus, racemis præcocibus multifloris, erectis apicem versus ramulorum confertis, bracteis minutis ovatis caducis, floribus pedicellatis 3–4-fasciculatis, petalis membranaceis calyce longioribus, ovario glabro.

*Hab.* Old Calabar, collected by the *Rev. W. C. Thomson.*

But two species of this genus were previously known, viz. *P. Malayana* and *P. Madagascariensis*, natives respectively of the Malayan peninsula and of Madagascar. *P. Guineensis* forms, therefore, an interesting addition to the few congeneric representatives in West Tropical Africa of purely Malayan or of Malayan and at the same time Madagascar or Ceylon species. This new *Paropsia* differs remarkably in habit from its congeners in its precocious flowers, which are arranged in leafless racemes crowded towards the ends of the branches instead of in the axils of the leaves. The flowers, however, are fascicled in the axils of minute caducous bracts. Excepting in the more membranous and glabrous petals and glabrous ovary, I do not remark any important difference in the flowers of *P. Guineensis*, unless it be a tendency of the ovules to develope towards the upper part, or above the middle, of the placentary lines of the ovary instead of below the middle, or towards the base of the cavity.

# On the Individual Sterility and Cross-Impregnation of certain Species of *Oncidium*. By Mr. John Scott, of the Royal Botanic Gardens, Edinburgh. Communicated by C. Darwin, Esq., F.R.S. & L.S.

[Read June 2, 1864.]

The writings of Kölreuter, Gärtner, and others furnish us with several illustrations of hermaphrodite plants whose two sexual elements are so modified in their action on each other that they are utterly sterile; the individual goodness of both the male and female elements being nevertheless shown by their facility in uniting with other individuals of the same species or with distinct species. With the view of further illustrating these singular phenomena, I, at the suggestion of Mr. Darwin, commenced a series of experiments, in repetition of those made by previous observers, as well as original experiments on distinct subjects. I have already communicated a few of these to the Botanic Society of Edinburgh (*vide* 'Proceedings,' 1863), of which, from their more or less immediate relation with the present notice, I will give a brief preliminary abstract. The species experimented upon were the *Oncidium sphacelatum*, *O. altissimum*, *O. divaricatum* var. *cupreum*, *O. graminifolium*, and *O. ornithorhynchum*.

First, I impregnated six flowers of the *O. sphacelatum* with pollinia of the *O. divaricatum* var. *cupreum*, from which I obtained four fine plump capsules. These being in an immature state, when I made my communication to the Botanic Society of Edinburgh, I was unable to say anything respecting the condition of the seeds. Now, as I have examined the capsules, I may state that each was well filled with seeds, of which about one-fifth were embryonated.

Secondly, I applied the pollinia of *O. sphacelatum* to the stigmas of six flowers of the *O. graminifolium*, from which I obtained one good capsule with one-fourth of embryonated seeds. I failed to effect a reciprocal cross by applying pollinia from *O. graminifolium* to the stigmas of *O. sphacelatum*, as all the flowers thus operated upon dropped early.

Thirdly, I applied the pollinia of *O. sphacelatum* to the stigmas of *O. ornithorhynchum*, and from four flowers thus impregnated I obtained one capsule. On dissection I was disappointed by finding that it contained few seeds, and of these a very high percentage presented merely a loose transparent testa, entirely destitute of an embryo. I did not succeed in impregnating *O. sphacelatum* by pollinia of *O. ornithorhynchum*, though the capsules thus treated in several instances showed symptoms of swelling.

Fourthly, I tried repeatedly to fertilize *O. sphacelatum* with the pollinia of *O. altissimum*, and also to reciprocally fertilize *O. altissimum* by pollinia of *O. sphacelatum*, yet in both cases I utterly failed. It is here worthy of remark, as showing how completely independent the conjunctive capacity of two distinct species may be of their systematic affinities, that the *O. altissimum* and *O. sphacelatum*, which I have thus failed to cross, are nevertheless so closely allied as to have been regarded as conspecific, whereas in the previously given fertile unions of *O. sphacelatum* with *O. divaricatum* var. *cupreum*, *O. graminifolium*, and *O. ornithorhynchum*, there are great dissimilarities in the specific characters.

Fifthly, I impregnated a number of flowers on different plants of the *O. sphacelatum* with their own pollinia, yet in no instance did a single capsule swell. The only external signs the flowers afforded of being affected by the pollinia were the closing of the stigmatic orifice, twenty-four hours or so after their application, and the slightly earlier withering of the flowers. On the plant of *O. sphacelatum*, previously noticed as readily susceptible to fertilization by the pollinia of *O. divaricatum cupreum*, I fertilized upwards of 200 flowers with own pollinia, yet every capsule proved abortive. That this inveterate abortion of the capsules was neither due to the non-emission nor to the non-penetration of the pollen-tubes, I satisfied myself by the dissection and examination of the columns of many of these flowers as they dropped off, and in all I invariably found an abundance of pollen-tubes.

Such then is a brief abstract of the experiments illustrative of the peculiarities in the reproductive economy of certain species of *Oncidium*, as communicated to the Botanic Society of Edinburgh, and I will now proceed to give in fuller detail a series of experiments which I have lately made on the above and other species of *Oncidium* in the Royal Botanic Gardens of Edinburgh, as further illustrating the capriciousness of their relations in respect to fertility. Those which I have now to record were performed upon two perfectly self-sterile plants of *O. microchilum*—respectively given in the sequel as Nos. 1 and 2—and plants of the *O. ornithorhynchum* and *O. divaricatum cupreum*; they are as follows:—

First, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chamber of eight flowers of the *O. ornithorhynchum*; of these, three produced capsules containing about 21 per cent. of good seed. I also tried the converse experiment, and applied pollinia from the *O. ornithorhynchum* to the stigmatic chambers of twelve flowers of the *O. microchilum* (No. 2), but in this case I failed in causing a single capsule to swell. To satisfy myself that this abortion of the capsules was not simply due to the non-development of the pollen-tubes, I dissected the columns of many of the flowers, and found in each an abundance of pollen-tubes.

Secondly, I inserted pollinia from the *O. microchilum* (No. 1) into the stigmatic chambers of eight flowers of the *O. ornithorhynchum*, and obtained five capsules. Of these one was perfectly developed, but yielded no good seed; the others, however, were well developed, and yielded about 16 per cent. of good seed. I tried the converse experiment likewise, and applied pollinia from the *O. ornithorhynchum* to the stigmatic chambers of twelve flowers of the *O. microchilum* (No. 1), yet I failed to obtain a single good capsule, though I had hopes, from the early development of two of them, that the results would have been otherwise; both dropped prematurely, although on dissection of the columns of several of the flowers I found an abundance of pollen-tubes. As shown, however, the pollinia of the *O. ornithorhynchum* in the present as in the above case, though thus absolutely ineffective in the fertilization of *O. microchilum* (No. 1), are nevertheless good, as I have proved by their application to their own stigmas as well as to those of *O. pumile*, fertile unions having in several instances been thus effected.

Thirdly, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chambers of six flowers of the *O. divaricatum cupreum*, and obtained three capsules, which yielded about 36 per cent. of good seed. I likewise tried the converse experiment, and applied pollinia of the *O. divaricatum cupreum* to the stigmas of six flowers of the *O. microchilum* (No. 2), yet though two of these produced capsules, I could not, after a most careful examination of their contents, detect an embryonated seed. I repeated this experiment on twelve other flowers with even less success than before, as every capsule aborted.

Fourthly, I inserted pollinia of *O. microchilum* (No. 1) into the stigmatic chambers of six flowers of *O. divaricatum cupreum*, and obtained four capsules, which contained about 34 per cent. of good seed. By the converse experiment I had, from six flowers of the *O. microchilum* (No. 1), impregnated by pollinia of *O. divaricatum cupreum*, two capsules, which yielded 42 per cent. of good seed.

Fifthly, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chambers of six flowers of the *O. microchilum* (No. 1), and obtained five capsules, of which four were good, yielding about 75 per cent. of embryonated seeds. I also tried the converse experiment, and applied pollinia (known to be good from their action on other species) of *O. microchilum* (No. 1) to the stigmas of six flowers of *O. microchilum* (No. 2), but in this case every capsule aborted. Struck with the great difference in the results of these reciprocal crosses, I repeated the last experiment, and impregnated in the same manner twelve other flowers of the *O. microchilum* (No. 1), but the result was similar, all the flowers proving abortive.

Sixthly, I impregnated twelve flowers of *O. microchilum* (No. 1) by its own pollen, yet not one produced a capsule. I repeated this experiment on twelve other flowers with the same result. The insusceptibility of this plant to fertilization by its own pollen interested me, so that I again and again repeated the experiment, but the foregoing results were repeated, not one capsule ever having set. I may state that on dissection of the columns of a number of these flowers, I invariably found them abundantly permeated by the pollen-tubes.

Seventhly, I impregnated twelve flowers of *O. microchilum* (No. 2) by its own pollen; nevertheless, though in this instance again pollen-tubes were freely developed, they failed in effecting a fertilizing influence: not one capsule swelled. By a repetition of this experiment on twelve flowers, I had nearly the same results, one flower alone producing a capsule; but this dropped off prematurely and contained no embryonated seeds. From this indication, however, of a certain degree of susceptibility in this plant to its own pollinic influence, I repeated the above experiment on a vast number of flowers, but the result in all was the same; and I observed in no single instance even the slightest symptom of a capsule swelling.

For the sake of clearness I will here give, in a tabulated form, the results of the above experiments, thus:—

Unions between *Oncidium microchilum*, *O. divaricatum* var. *cupreum*, and *O. ornithorhynchum*.

| | Number of flowers fertilized. | Total number of capsules produced. | Number of good capsules. | Estimated total number of seeds produced. | Estimated number of good seeds. | By calculation. | |
|---|---|---|---|---|---|---|---|
| | | | | | | Total seeds. | Good seeds. |
| 1. *O. ornithorhynchum* by pollinia of *O. microchilum* (No. 2) ...... | 8 | 3 | 3 | 20,200 | 4,242 | or as 1000 | to 210 |
| 2. *O. microchilum* (No. 2) by pollinia of *O. ornithorhynchum* ........ | 12 | 0 | | | | | |
| 3. *O. ornithorhynchum* by pollinia of *O. microchilum* (No. 1) ...... | 8 | 5 | 4 | 23,360 | 3,737 | or as 1000 | to 160 |
| 4. *O. microchilum* (No. 1) by pollinia of *O. ornithorhynchum* ........ | 12 | 2 | 0 | | | | |
| 5. *O. divaricatum cupreum* by pollinia of *O. microchilum* (No. 2) ... | 6 | 3 | 3 | 22,050 | 7,938 | or as 1000 | to 360 |
| 6. *O. microchilum* (No. 2) by pollinia of *O. divaricatum cupreum* ... | 18 | 2 | 0 | | | | |
| 7. *O. divaricatum cupreum* by pollinia of *O. microchilum* (No. 1) ... | 6 | 4 | 4 | 26,240 | 8,922 | or as 1000 | to 340 |
| 8. *O. microchilum* (No. 1) by pollinia of *O. divaricatum cupreum* ... | 6 | 2 | 2 | 17,700 | 7,434 | or as 1000 | to 420 |
| 9. *O. microchilum* (No. 1) by pollinia of *O. microchilum* (No. 2) ... | 6 | 5 | 4 | 45,800 | 34,350 | or as 1000 | to 750 |
| 10. *O. microchilum* (No. 2) by pollinia of *O. microchilum* (No. 1) ... | 18 | 0 | | | | | |
| 11. *O. microchilum* (No. 1) by own pollen......... | 24 | 1 | 0 | | | | |
| 12. *O. microchilum* (No. 2) by own pollen......... | 24 | 0 | | | | | |

In the first four columns of the above Table the number of flowers fertilized and the total number of capsules and seeds produced are shown; in the fifth column I have given, by a careful microscopic examination in each case of 1000 seeds, the relative number of embryonated seeds produced; and lastly, in the column at the right hand, for facility of comparison, the exact number of good seeds produced per 1000 of the total product is given.

By a summary comparison of these results we have the following highly interesting facts disclosed. First, we see that the male element of *O. microchilum* (No. 1) will fertilize the female element of the two distinct species, *O. ornithorhynchum* and *O. divaricatum cupreum*, and yet be completely impotent upon its own female element; nevertheless the susceptibility of the latter (female element) to fertilization is shown by its fertile unions with another individual of the same species, and likewise by a fertile union with an individual of a distinct species, namely, *O. divaricatum cupreum*. Secondly, the male element of *O. microchilum* (No. 2) will fertilize the female element of *O. ornithorhynchum* and *O. divaricatum cupreum*, and likewise another individual of its own species, though on its own female element it is utterly ineffective.

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## On a New Genus of *Moraceæ*, from Sumatra and Singapore. By Mr. SALPIZ KURZ, Curator of the Herbarium of the Botanic Gardens, Calcutta. With a Note by Dr. ANDERSON. Communicated by T. ANDERSON, M.D., F.L.S.

[Read June 2, 1864.]

[PLATE XIII.]

THE plant, of which a generic diagnosis and a specific description are appended by Mr. Kurz, the newly appointed Curator of the Herbarium of the Calcutta Botanic Gardens, is an imperfectly described species, which yields some of the valuable timber known as Iron-wood in the Dutch East Indian Possessions.

Messrs. Teijsmann and Binnendyk, in describing another tree, *Eusideroxylon Zwageri*, T. et B., which produces Iron-wood (*vide* Tydschrift voor Nederl. Indie, 1863), enumerate the species known to them to afford the same class of timber. These are, *Eusideroxylon Zwageri*, T. et B.; *Namia vera*, Miq.; *Intsia Amboinensis*, Thouars; *Cassia florida*, Vahl; *Memecylon ferreum*, Blume; *Stadmannia Sideroxylon*, DC.; *Dodonæa Waitziana*, Blume; and *Sloetia Sideroxylon*, T. et B. The last of these, *Sloetia Sideroxylon*, has received no further notice from Teijsmann and Binnendyk, that I can find, beyond this indication of the name. Its history is interesting. In the first place, it is the *Artocarpus elongatus*, Miq., in the Supplement to the 'Flora Indiæ Batavæ,' p. 419, a species described from specimens sent by Mr. Teijsmann from Sumatra. Living specimens were also taken by Mr. Teijsmann to the Botanic Garden, Buitenzorg, where they have grown to the height of 25 or 30 feet. They have produced flowers, from which Mr. Kurz has drawn up the generic description. I have found this species also at Singapore, in a few of the dense forests that still exist on the island; and specimens in flower, and immature fruit, are in the Herbarium of the Calcutta Botanic Garden.

Mr. Kurz was enabled to identify the plant with Professor Miquel's *Artocarpus elongatus* (*vide supra et infra*) by a set of Mr. Teijsmann's Sumatran collections having been kept in the Herbarium of the Buitenzorg Botanic Garden, while a set, correspondingly numbered, was sent to Utrecht. The specimen of this species sent to Professor Miquel probably contained no female flowers. If ovaries had been present, they would have attracted his notice, and shown the generic distinctness of the plant from *Artocarpus*.

T. ANDERSON.

Botanic Garden, Calcutta,
April 6, 1864.

SLOETIA, *Teijsm. et Binnend.*, absque descriptione.

Flores monoici, peltato-bracteolati, amentacei. *Masc.* Perigonium 3-lobum, æstivatione valvatum; stamina 3; pistilli rudimentum nullum; filamenta incumbentia, elastice exsilientia. *Fœm.* Perigonium 4-fidum; laciniæ biseriales, interiores exterioribus paulo minores; ovarium sessile, ovulo pendulo parieti styligero affixo; stylus subterminalis, breviusculus; stigmata 2, longissima, pubera. Achænium perigonio paulo indurescente inclusum, dein elastice ejectum.

Genus novum Artocarpearum prope *Toxotrophin* est inserendum.

SLOETIA SIDEROXYLON, *T. et B. in Tydschr. Nat. Ver.* 1863 (nomen solum).

Arbor vasta (in Hort. Bot. nunc 25-pedalis), lactescens, trunco ramisque cinerascentibus, ligno duro, ramulis divergentibus teretibus glabris viridibus. Innovationes puberes, cito glabrescentes. Stipulæ leanari-lanceolatæ, acuminatæ, membranaceæ, glabræ, deciduæ. Folia chartacea, alterna, breviter petiolata, e basi acuta v. subcuneata oblongo- v. elliptico-lanceolata, breviuscule acuminata, passim inæquilatera, integra, glabra, supra lucida; nervi laterales 12–15 utrinque costaque utraque pagina prominuli; petiolus usque pollicem fere longus, teres, glaber. Amenta axillaria, geminata, rarius abortu solitaria, breviter ($\frac{1}{3}$ poll.) pedunculata, subtus nuda, supra floribus masculis densissime obducta, fœmineis paucis multo majoribus intermixtis. Bracteolæ trigono-peltatæ, minutæ, pilosulæ, ciliolatæ, virides. Flores sessiles, compacti, viridiusculi, dein albescentes. Sepala florum masc. basi in tubum brevem connata, extus pilosula, ea flor. fœm. libera, exteriora pubera, dein hirtella, interiora lævia, teneriora. Achænium pisi majoris magnitudine, stylo persistente auctum, perigonio hirtello inclusum, maturescens contactu etiam levi elastice (ad 6 metr.) exsiliens.

In sylvis Sumatræ; in prov. Palembang; in prov. Padang prope Lumut et ad littora prope Siboga, *Teijsmann.* Ins. Singapora, *T. Anderson, M.D.*

Nom. vernac. Kapinie.

Synon. Artocarpus elongatus, *Miq. Fl. Ind. Bat. Suppl.* p. 172 et 419.

TAB. XIII. fig. 1. Ramus floriferus magnit. nat.; fig. 2. Flos ♂ et ♀ auct. ut fig. sequent.; fig. 3. Sepalum exter. fl. ♀ a dorso; fig. 4. Sepal. inter. fl. ♀; fig. 5. Ovarium; fig. 6. idem, verticaliter transsect.; fig. 7. Semen, tegmento remoto.

## On the Sexual Relations of the Three Forms of *Lythrum salicaria*.

By CHARLES DARWIN, F.R.S., F.L.S., &c.

[Read June 16, 1864.]

SOME of the species of *Lythrum* offer in their manner of fertilization a more remarkable case than can, perhaps, be found in any other plant or animal. In *Lythrum salicaria* three plainly different forms occur: each of these is an hermaphrodite, each is distinct in its female organs from the other two forms, and each is furnished with two sets of stamens or males differing from each other in appearance and function. Altogether there are three females and three sets of males, all as distinct from each other as if they belonged to different species; and if smaller functional differences are considered, there are five distinct sets of males. Two of the three hermaphrodites must coexist, and the pollen be carried by insects reciprocally from one to the other, in order that either of the two should be fully fertile; but unless all three forms coexist, there will be waste of two sets of stamens, and the organization of the species, as a whole, will be imperfect. On the other hand, when all three hermaphrodites coexist, and the pollen is carried from one to the other, the scheme is perfect; there is no waste of pollen and no false co-adaptation. In short, nature has ordained a most complex marriage-arrangement, namely a triple union between three hermaprodites,—each hermaphrodite being in its female organ quite distinct from the other two hermaphrodites and partially distinct in its male organs, and each furnished with two sets of males.

The three forms may be conveniently called, from the unequal lengths of their pistils, the *long-styled*, *mid-styled*, and *short-styled*. Their existence and differences were first observed by Vaucher*, and subsequently more carefully by Wirtgen; but, not being guided by any theory, neither author perceived some of the most curious points of difference. I will first briefly describe the three forms by the aid of the accompanying accurate diagram, which shows the flowers, six times magnified, in their natural position, with their petals and the near side of the calyx removed.

*Long-styled form.*—This can at once be recognized by the length of the pistil, which is (including the ovarium) fully one-third longer than that of the mid-styled, and more than thrice as long as that of the short-styled form. It is so disproportionately long, compared with the flower, that it projects in the bud through the unfolded petals. It stands out considerably beyond the longer stamens; its terminal portion depends a little, but the stigma itself is slightly upturned: the globular stigma is considerably larger than that of the other two forms. The six longer stamens project about two-thirds of the length of the pistil, and correspond in length with the pistil of the mid-styled form. The correspondence with the pistil in length in this and the two following cases is generally very close; the difference, where there is any, being usually in a slight excess of length in the stamens. The six shorter stamens (each of which alternates with a longer one) lie concealed within the calyx; their ends are upturned, and they are graduated in length, so as to form a triple row—both which characters are here much more marked than with the longer stamens, which vary in these respects. The anthers of the shorter stamens are smaller than those of the longer stamens. Knowing that the pollen differs greatly in the longer and shorter stamens of the two other forms, I carefully compared that of the two sets of stamens in this form: in both the pollen-grains are yellow, but they are a little larger in the longer than in the shorter stamens. The difference is slight, so that I convinced myself of its reality only by putting two small heaps close together under the compound mi-

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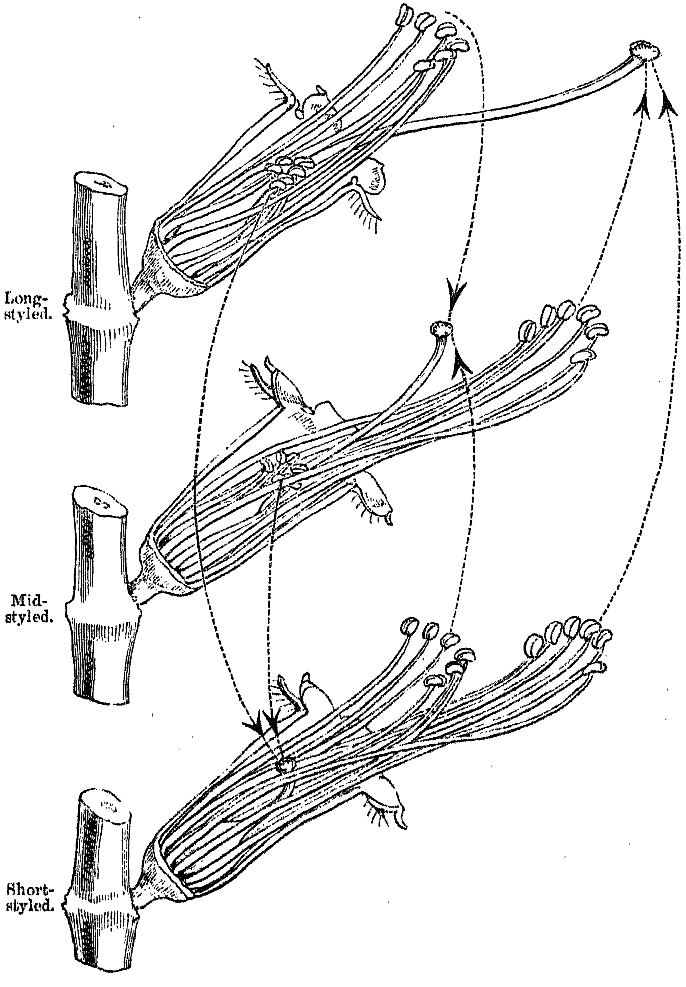
* Hist. Phys. des Plantes d'Europe, tom. ii., 1841, p. 371. Wirtgen, "Ueber *Lythrum salicaria* und dessen Formen," Verhand. des naturhist. Vereins der preuss. Rheinl., 5. Jahrgang, 1848, S. 7.



Diagrams of the flowers of the three forms of *Lythrum salicaria*, in their natural position, with the petals removed and with the near side of the calyx cut away: enlarged six times.

The dotted lines with the arrows show which pollen must be applied to each stigma to cause full fertility.

croscope, and I found I could always (with one exception) distinguish them: I then showed the specimens to two other persons, and they likewise distinguished the two kinds and pointed out which was the largest. The capsules of this form contain, on an average, 93 seeds: how this average was obtained will presently be explained. I repeatedly observed that the seed, when cleaned, seemed larger than that from the mid-styled or short-styled forms; consequently I placed 100 long-styled seeds in a good balance, and by the double method of weighing found that they equalled 121 seeds of the mid-styled and 142 of the short-styled; or, in short, that five long-styled seeds equalled six mid-styled and seven short-styled seeds. These slight differences in the weight of the seed, and, as we shall soon see, in the average number produced, are worth recording, as they characterize not mere varieties but coexisting forms of the same species.

*Mid-styled form.*—The pistil occupies the position represented in the diagram, with its extremity considerably, but in a variable degree, upturned; the stigma is seated between the anthers of the long and the short stamens. The six longer stamens correspond in length with the pistil of the long-styled form; their filaments are coloured bright pink; the anthers are dark-coloured, but from containing bright green pollen and from their early dehiscence they appear emerald-green. Hence the general appearance of these stamens is remarkably dissimilar from that of the longer stamens of the long-styled form. The six shorter stamens, enclosed within the calyx, resemble in all respects the shorter stamens of the long-styled form, and both correspond in length with the short pistil of the short-styled form. The green pollen-grains of the longer stamens are plainly larger than the yellow pollen-grains of the shorter anthers: this fact was conspicuous in several camera-lucida drawings made for me by my son, Mr. W. E. Darwin. There is some variability in size, but $\frac{13}{7000}$ of an inch may be taken as about the average diameter of the green pollen-grains when distended with water, and $\frac{9}{7000}$ as the diameter of the yellow grains of the shorter stamens; so that the difference in diameter is in about the proportion of four to three. The capsules contain, on an average, 132 seeds; but, perhaps, as we shall see, this is rather too high an average. The seeds themselves are smaller than those of the long-styled form.

*Short-styled form.*—The pistil is here very short, not one-third of the length of that of the long-styled form. It is enclosed within the calyx, which, differently from in the other two forms, does not enclose any anthers. The end of the pistil is generally bent upwards at right angles. The six longer stamens, with their pink filaments and green pollen, resemble in size of the grains and in all respects the longer stamens of the mid-styled form, and both correspond in length with the long-styled pistil. The six shorter stamens, with their uncoloured filaments and yellow pollen, resemble in size of the grains and in all respects the longer stamens of the long-styled form, and both correspond in length with the mid-styled pistil. The capsules contain fewer seeds on an average than in either of the preceding forms, namely 83·5, and they are considerably smaller in size. In this latter respect, but not in number, there is a gradation parallel to that of the length of the pistil, the long-styled having the largest, the mid-styled the next in size, and the short-styled the smallest seed.

From this description we see that there are three distinct female organs, or rather females as they are borne on distinct individuals, differing in the length and curvature of the style, in the size of the stigma, and in the number and size of the seed. In the three forms, taken together, there are thirty-six stamens or males, and these can be divided into three sets of a dozen each, differing from each other in length, curvature, and colour of the filaments, in the size of the anthers, and especially in the colour and diameter of the pollen-grains. Each of the three forms bears half-a-dozen of one kind of stamens and half-a-dozen of another kind, but not all three kinds. The three kinds correspond in length with the three pistils: the correspondence is always between half the stamens borne by two forms with the pistil of a third form. These remarks apply to the structure, and not, as yet, to the functions, of the reproductive organs.

I ascertained the average number of seed by counting them in eight fine selected capsules taken from plants of the three forms growing wild, and the result was, as we have seen, for the long-styled (neglecting decimals) 93, mid-styled 132, and short-styled 83. I should not have trusted this result, but I had a number of plants in my garden which, from their youth, did not yield the full complement of seed, but they were of exactly the same age and grew under exactly the same conditions, and were freely visited by bees. I took six fine capsules from each, and found the average to be for the long-styled 80, for the mid-styled 97, and for the short-styled 61. Lastly, I made numerous artificial unions, and, as may be seen in the following Tables, these gave in the long-styled an average of 90 seeds, in the mid-styled 117, and in the short-styled 71. So that we have good concurrent evidence of the different average production of seed by the three forms. To show that the artificial fertilizations, presently to be described, produced their full effect and may be trusted, I may state that one mid-styled capsule yielded 151 good seeds, which is the exact number of the finest wild capsule examined by me. Artificially fertilized short- and long-styled capsules actually produced a greater number of seeds than I have found in wild plants, but then I did not examine many of the latter. This Lythrum, I may add, offers a remarkable instance, how profoundly ignorant we are of the life-conditions of each species: naturally it grows "in wet ditches, watery places, and especially on the banks of streams," and though it produces so many minute seeds, it never spreads on the adjoining land; yet, planted in my garden, on clayey soil lying over the chalk, and which is so dry that a rush cannot be found, it thrives luxuriantly, grows to above six feet in height, produces self-sown seedlings, and (which is a severer test) is fully as fertile as in a state of nature. Nevertheless it would be almost a miracle to find this plant spontaneously growing on such land as my garden, though under its native climate.

According to Vaucher and Wirtgen, the three forms coexist in all parts of Europe. Some friends gathered for me in North Wales a number of twigs from separate plants growing near each other, and then classified them. My son did the same in Hampshire, and here is the result:—

| | Long-styled. | Mid-styled. | Short-styled. | Total. |
|---|---|---|---|---|
| North Wales | 95 | 97 | 72 | 264 |
| Hampshire. | 53 | 38 | 38 | 129 |
| Total.... | 148 | 135 | 110 | 393 |

If twice or thrice the number had been collected, probably the three forms would have been found nearly equal; I infer this from considering the above figures, and from my son telling me that if he had collected in another spot, he felt sure that the mid-styled plants would have been in excess. I several times sowed small parcels of seed, and raised all three forms; but I neglected to record the parent form, except in one instance, in which I raised from short-styled seed twelve plants, of which only one turned out long-styled, four mid-styled, and seven short-styled.

Insects are necessary for the fertilization of this Lythrum. During two years I kept two plants of each form protected, and in the autumn they presented a remarkable contrast in appearance with the adjoining uncovered plants, which were densely covered with capsules. In 1863 a protected long-styled plant produced only five poor capsules; two mid-styled plants produced the same number; and two short-styled plants between them produced only one: these capsules contained very few seed; yet the plants were fully productive when artificially fertilized under the net. In a state of nature the flowers are incessantly visited for their nectar by hive- and humble-bees and various Diptera. The nectar is secreted all round the base of the ovarium; but a passage is formed along the upper and inner side of the calyx by the lateral deflection (not represented in the diagram) of the basal portions of the filaments; so that insects invariably alight on the upper side of the flowers, on the projecting stamens and pistil, and insert their probosces along the upper inner margin of the calyx. We can now see why the ends of the stamens with their anthers, and the ends of the pistils with their stigma, are a little upturned, in order that they may brush against the lower hairy surfaces of the insects' bodies. The short stamens which lie enclosed within the calyx of the long- and mid-styled forms can be touched only by the proboscis and the narrow chin of the sucking bee; hence they have their ends more upturned, and they are graduated in length, so as to fall into a narrow file, three deep, sure to be raked by the thin intruding proboscis. The anthers of the longer stamens stand laterally further apart and are more nearly of the same length, for they have to brush against the whole breadth of the insect's body. I may here incidentally remark, that in very many flowers the pistil, or the stamens, or both, are rectangularly bent to one side of the flower: this bending may be permanent, as with *Lythrum* and many others, or may be effected (as in *Dictamnus fraxinella* and many others) by a temporary movement which occurs in the stamens when the anthers dehisce, and in the pistil when the stigma is mature; but these two movements are by no means always contemporaneous in the same flower. Now I have found no exception to the rule, that when the stamens and pistil are bent, the bending is exactly to that side of the flower which secretes nectar (even though there be a rudimentary nectary of large size on the opposite side, as in some species of *Corydalis*); or, when nectar is secreted on all sides, to that side where the structure of the flowers allows the easiest access to it, as in *Lythrum*, Papilionaceous flowers, and many others. The rule consequently is that when the pistil and stamens are bent, the stigma and anthers are brought into the pathway towards the nectary. There are a few cases which seem to be exceptions, but they are not so in truth: for instance, in the Gloriosa lily, the stigma of the grotesque and rectangularly bent pistil is brought, not into the pathway from the open air towards the nectar-secreting recesses of the flower, but into the circular route from one nectary to the other; in *Scrophularia aquatica* the pistil is bent downwards from the mouth of the flower, but it thus strikes the pollen-dusted breasts of the wasps which habitually visit these ill-scented blooms. In the above rule we see one more instance of the supreme dominating power of insects over all the minor structural details of flowers, especially of those which have irregular corollas. Flowers which are fertilized by the wind must of course be excepted, but I do not know of a single instance of an irregular flower which is fertilized or crossed by this means.

I have delayed too long on these points, but I must allude to one other. We have seen that the three pistils of different lengths have each two half-dozen sets of stamens of corresponding length. When bees suck the flowers, the longest stamens, bearing the green pollen, rub against the abdomen and the interior sides of the posterior legs, as does likewise the stigma of the long-styled form. The stamens of middle length and the stigma of the mid-styled form rub against the under side of the thorax and between the front pair of legs. The shortest stamens and the stigma of the short-styled form must rub against the proboscis and chin; for the bees in sucking insert only the front of their heads into the calyx. On catching bees, I observed much green pollen on the inner sides of the hind legs and on the abdomen, and much yellow pollen on the under side of the thorax. There was also pollen on the chin, and, it may be presumed, on the proboscis, but this was difficult to observe. I had, however, independent proof that pollen is carried on the proboscis; for in a protected short-styled plant (which produced only two capsules) one small branch was accidentally left during many days pressing against the fine net, and bees were seen inserting their probosces through the meshes, and in consequence numerous capsules were formed on this one small branch. From these several facts it follows that insects would chiefly carry to the stigma of each form pollen from the stamens of corresponding length; and we shall presently see the importance of this adaptation. It must not, however, be supposed that the bees do not get more or less dusted all over with the several kinds of pollen; they certainly do, as could be seen with the green pollen from the longest stamens. Moreover, a case will presently be given of a long-styled plant which grew absolutely by itself, and produced an abundance of capsules, which must have been fertilized by its own two kinds of pollen; but these capsules contained a very poor average of seed. Hence insects, and chiefly bees, act both as general carriers of pollen, and as special carriers of the right kind *.

*Variability.*—Before passing on to more important topics, I must say a few words on this head. Wirtgen remarks † on the variability in the branching of the stem, in the length of the bracteæ, size of the petals, and in several other respects. The plants now growing in my garden have their leaves arranged oppositely, alternately, and in whorls of three, and differ greatly in shape. The stems of the plants bearing leaves in whorls are hexagonal; those of the other plants are quadrangular. But we are concerned only with the reproductive organs: the upward bending of the pistil is variable, and in a remarkable degree in the short-styled form, in which it is sometimes straight, sometimes slightly curved, but generally upturned at right angles. The stigma of the long-styled pistil frequently has longer papillæ or is rougher than that of the mid-styled, and this than that of the short-styled form; but this character, though fixed and uniform with the two forms of *Primula*, is here variable, and I have seen mid-styled stigmas rougher than those of the long-styled. The degree to which the longer and middle stamens are graduated in length and are upturned at their ends is variable; sometimes all are equal. The colour of the green pollen in the long stamens is variable *, and is sometimes pale greenish yellow; in one short-styled plant it was almost white. The grains vary a little in size: I examined one short-styled plant with the grains above the average size; and I have seen a long-styled plant with undistinguishable grains from the longer and shorter anthers. We have here considerable fluctuations of character; and if any of these slight structural differences were of direct service to the plant, or were correlated with useful functional differences, we can perceive that the species is just in that state in which natural selection might readily do much for its modification.

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* In my paper on the two forms of *Primula* (Journal Proc. Linn. Soc. 1862, p. 85) I stated that I had only occasionally seen humble-bees sucking the flowers of the Cowslip (*P. veris*). Since then I have had some beds in my garden containing nearly 700 plants, and these were incessantly visited by *Bombus hortorum* and *B. muscorum*. I caught some of these bees, and I found (as I had anticipated in my paper, p. 86) that a vast majority of the pollen-grains which adhered to the base of the proboscis were large-sized and had come from the long stamens of the short-styled form, and were thus placed ready to fertilize the stigma of the long-styled form. On the other hand, on the middle, and near the tip of the proboscis, a very large proportion of the pollen-grains were of the small size, and had come from the short stamens of the long-styled form. My son caught, also, a moth (*Cucullia verbasci*) hovering over the bed, and I found on its proboscis a similar distribution of the two kinds of pollen-grains. I give these facts as a further illustration of the importance of the relative lengths of the stamens and pistil.

† Verhand. des naturhist. Vereins, 5. Jahrgang, 1848, S. 11, 13.

To return to our proper subject—we see that there are three kinds of females and three kinds of males, each kind of the latter being borne by half-dozens on two of the three forms. It remains to discover whether these several sexes or sexual organs differ from each other in function. Nothing brings more prominently forward the complexity of the reproductive system of this extraordinary plant, than the necessity, in order to ascertain the above fact, of artificially making eighteen distinct unions. Thus the long-styled form had to be fertilized with pollen from its own two distinct kinds of anthers, from the two in the mid-styled, and from the two in the short-styled form. The same process had to be repeated with both the mid- and short-styled forms. It might have been thought sufficient to have tried on each stigma the green pollen, for instance, from either the mid- or short-styled longer stamens, and not from both; but the result proves that this would have been insufficient, and that it was necessary to try all six kinds of pollen on each stigma. As in artificial fertilizations there will always be some failures, it would have been advisable to have

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* *Lagerstrœmia Indica*, one of the Lythraceæ, is strangely variable in its stamens—I presume in part due to its growth in a hothouse. The most perfect flowers produced with me five very long stamens with thick flesh-coloured filaments and green pollen, and from nineteen to twenty-nine short stamens with yellow pollen; but many flowers produced only one, two, three, or four long stamens with green pollen, which in some of the anthers was wholly replaced by yellow pollen; one anther offered the singular case of half, or one cell being filled with bright green, and the other cell with bright yellow pollen. One petal had a furrow near its base, which contained pollen. According to analogy with *Lythrum*, this species would produce three forms; if so, the above plant was a mid-styled form: it was quite sterile with its own two kinds of pollen.

repeated each of the eighteen unions a score of times; but the labour would have been too great; as it was, I made 223 artificial unions; *i. e.*, I fertilized, on an average, above a dozen flowers in the eighteen different methods. Each flower was castrated; the adjoining buds had to be removed, that the marking-thread, wool, &c. might be safely secured; and after each fertilization the stigma had to be examined with a lens to see that there was sufficient pollen. Plants of all three forms were protected during two years by large nets on a framework; two plants were used during one or both years, in order to avoid any individual peculiarity in any one plant. As soon as the flowers withered, the nets were removed; and in the autumn the capsules were daily inspected; when the seeds were ripe they were counted under the microscope. I have given these details that confidence may be placed in the following Tables, and as some excuse for two blunders which, I believe, I made. These blunders are referred to, with their probable causes, in two notes to the Tables; the erroneous numbers, however, are entered in the Tables, that it may not be supposed that I have in any one instance tampered with the results.

A few words explanatory of the three Tables must be given. Each is devoted to one form, and is divided into six compartments. The two upper ones in each table give the product of good seed from the application of pollen from the two sets of stamens which correspond in length with the pistil of that form. The two next lower compartments show the result of pollen from the other two sets of stamens, which do not correspond in length with the pistil, and which are borne by the same two forms. The two lowest compartments show the result of the application of each form's own two kinds of pollen. The term "own pollen," used here and in the Tables, does not mean pollen from the flower to be fertilized —for this was never used—but from another flower on the same plant, or more commonly from a distinct plant of the same form. In the result given, "0" generally means that no capsule was produced, or that the capsule contained no good seed. In some part of each row of figures in each compartment, a short horizontal line may be seen; the unions above this line were made in 1862, and below it in 1863. It is of importance to observe this, as it shows that the same general result ensued in two successive years; but more especially because 1863 was a very hot and dry season, and the plants had occasionally to be watered. This did not prevent the full complement of seed being produced from the more fertile unions; but it rendered the less fertile unions even more sterile than they otherwise would have been. I have seen striking instances of this same fact in making homomorphic and heteromorphic unions in *Primula**; and it is well known that the conditions of life must be highly favourable to give any chance of producing hybrids from species which cross with difficulty.

Table I.—LONG-STYLED FORM.

| I. | | II. | |
|---|---|---|---|
| 13 flowers fertilized by the longer stamens of the mid-styled. *These stamens equal in length the pistil of the long-styled.* | | 13 flowers fertilized by the longer stamens of the short-styled. *These stamens equal in length the pistil of the long-styled.* | |
| Product of good seed in each capsule. | | Product of good seed in each capsule. | |
| 36 | 53 | 159 | 104 |
| 81 | 0 | 43 | 119 |
| 0 | 0 | 96 poor seed. | 96 |
| 0 | 0 | 103 | 99 |
| 0 | 0 | 0 | 131 |
| — | 0 | 0 | 116 |
| 45 | | — | |
| 41 | | 114 | |
| 38 per cent. of these flowers yielded capsules. Each capsule contained, on an average, 51·2 seed. | | 84 per cent. of these flowers yielded capsules. Each capsule contained, on an average, 107·3 seed. | |

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* In the spring of 1862 I crossed forty Cowslip flowers (*P. veris*) heteromorphically and homomorphically. The plants were accidentally exposed in the greenhouse to too hot a sun, and a number of umbels perished. Some, however, remained in moderately good health, and on these there were twelve flowers which had been fertilized heteromorphically and eleven which had been fertilized homomorphically. The twelve heteromorphic unions yielded seven fine capsules, containing on an average 57·3 good seed. Now mark the difference: the eleven homomorphic unions yielded only two capsules, of which one contained 39 seeds, but so poor, that I do not suppose one would have germinated, and the other only 17 fairly good seed. It would be superfluous to give any more details on this experiment, or on some which I made at the same time on *P. Sinensis*, after the appearance of Mr. John Scott's admirable paper on the various dimorphic species of *Primula*, in which he confirms my former results, and adds many original and valuable observations. Dr. Hildebrand has also (Botanische Zeitung, 1864, Jan. 1, S. 3) confirmed my general results with respect to *P. Sinensis*, and has corrected an error into which in some unaccountable manner I fell, namely, that the pollen-grains from the long- and short-styled forms were of the same size. Dr. Hildebrand has added a series of new and important experiments, for he fertilized homomorphically a number of flowers with pollen from the same form, and likewise from the same individual flower. These latter he found were thus rendered rather more sterile. This experiment, I believe, has never been systematically tried before.

Table I.—LONG-STYLED FORM (*continued*).

| III. 14 flowers fertilized by the short stamens of the mid-styled. | | IV. 12 flowers fertilized by the shorter stamens of the short-styled. | |
|---|---|---|---|
| 3 | 0 | 20 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | — | 0 |
| — | 0 | 0 | 0 |
| 0 | 0 | 0 | |
| 0 | | | |
| Too sterile for any average. | | Too sterile for any average. | |

| V. 15 flowers fertilized by *own* longer stamens. | | VI. 15 flowers fertilized by *own* shorter stamens. | |
|---|---|---|---|
| 2 | — | 4 | — |
| 10 | 0 | 8 | 0 |
| 23 | 0 | 4 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| Too sterile for any average. | | Too sterile for any average. | |

I fertilized a considerable number of flowers with pollen, taken by a camel's-hair brush, from both the long and short stamens of their own (long-styled) form; but I did not examine with a lens (as I did in the cases in the Tables) whether sufficient pollen had been placed on the stigma: only 5 capsules were produced, and these yielded on an average 14·5 seed. In 1863 I tried a much better experiment: a long-styled plant was grown by itself, miles away from any other plant, so that its stigmas could have received only the two kinds of pollen proper to this form. The flowers were incessantly visited by bees, so that the stigmas must have received on the most favourable days, and at the most favourable hours, successive applications of pollen: all who have crossed plants know that this highly favours fertilization. This plant produced an abundant crop of capsules; I took by chance 20, and these (excluding one poor one) contained seed as below:—

| | | | | |
|---|---|---|---|---|
| 20 | 20 | 35 | 21 | 19 |
| 26 | 24 | 12 | 23 | 10 |
| 7 | 30 | 27 | 29 | 13 |
| 20 | 12 | 29 | 19 | 35 |

This gives an average of 21·5 seed per capsule; and as we know that this form, when standing near plants of the other two forms and fertilized by insects, produces an average of 93·1 seed per capsule, we see that the long-styled form fertilized by its own two pollens yields only between one-fourth and one-fifth of the full number of seed. I have spoken as if this plant had received both its own kinds of pollen, and this is, of course, possible; but, from the enclosed position of the shorter stamens, it is much more probable that the stigma received almost exclusively the pollen from its own longer stamens.

## Table II.—MID-STYLED FORM.

### I.

12 flowers fertilized by the longer stamens of the long-styled. *These stamens equal in length the pistil of the mid-styled.*

Product of good seed in each capsule.

| | |
|---|---|
| 138 | 122 |
| 149 | 50 |
| 147 | 151 |
| 109 | 119 |
| 133 | 138 |
| 144 | 0 |
| — | |

92 per cent. of the flowers (probably 100 per cent.) yielded capsules. Each capsule contained, on an average, 127·3 seed.

### II.

12 flowers fertilized by the shorte stamens of the short-styled. *Thes stamens equal in length the pistil o the mid-styled.*

Product of good seed in each capsule.

| | |
|---|---|
| 112 | 109 |
| 130 | 143 |
| 143 | 124 |
| 100 | 145 |
| 33 | 12 |
| — | 141 |
| 104 | |

100 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 108·0 seed; or, excluding capsules with less than 20 seed, the average is 116·7 seed.

### III.

13 flowers fertilized by the short stamens of the long-styled.

| | | |
|---|---|---|
| 83 | 12 | |
| 0 | 19 | seed small and poor. |
| 0 | 85 | |
| — | 0 | |
| 44 | 0 | |
| 44 | 0 | |
| 45 | 0 | |

54 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 47·4 seed; or, excluding capsules with less than 20 seed, the average is 60·2 seed.

### IV.

15 flowers fertilized by the longer stamens of the short-styled.

| | |
|---|---|
| 130 | 86 |
| 115 | 113 |
| 14 | 29 |
| 6 | 17 |
| 2 | 113 |
| 9 | 79 |
| — | 128 |
| 132 | 0 |

93 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 69·5 seed; or, excluding capsules with less than 20 seed, the average is 102·8.

### V.

12 flowers fertilized by *own* longer stamens.

| | |
|---|---|
| 92 | 0 |
| 9 | 0 |
| 63 | 0 |
| — | 0 |
| 136?* | 0 |
| 0 | 0 |
| 0 | |

Excluding the capsule with 136 seed, 25 per cent. of the flowers yielded capsules, and each capsule contained, on an average, 54·6 seed; or, excluding capsules with less than 20 seed, the average is 77·5.

### VI.

12 flowers fertilized by *own* shorter stamens.

| | |
|---|---|
| 0 | 0 |
| 0 | 0 |
| 0 | 0 |
| — | 0 |
| 0 | 0 |
| 0 | 0 |
| 0 | |

0 per cent. of the flowers yielded capsules.

---

* I have hardly any doubt that this result of 136 seed is due to a gross error. The flowers to be fertilized by their own longer stamens were first marked by

I fertilized a considerable number of flowers with pollen, taken by a camel's-hair brush, from both the long and short stamens of their own (short-styled) form; but I did not examine with a lens (as I did in the cases in the Tables) whether sufficient pollen had been placed on the stigma: only 5 capsules were produced, and these yielded, on an average, 11·0 seed.

### Table III.—SHORT-STYLED FORM.

| I. | | II. | |
|---|---|---|---|
| 12 flowers fertilized by the shorter stamens of the long-styled. *These stamens equal in length the pistil of the short-styled.* | | 13 flowers fertilized by the shorter stamens of the mid-styled. *These stamens equal in length the pistil of the short-styled.* | |
| 69 | 56 | 93 | 69 |
| 61 | 88 | 77 | 69 |
| 88 | 112 | 48 | 53 |
| 66 | 111 | 43 | 9 |
| 0 | 62 | 0 | 0 |
| 0 | 100 | 0 | 0 |
| — | | — | 0 |
| 83 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 81·3 seed. | | 61 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 64·6 seed. | |
| III. | | IV. | |
| 10 flowers fertilized by the longer stamens of the long-styled. | | 10 flowers fertilized by the longer stamens of the mid-styled. | |
| 0 | 14 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| — | 0 | — | 0 |
| 23 | | 0 | |
| Too sterile for any average. | | Too sterile for any average. | |

"white thread," and those by the longer stamens of the long-styled form by "white silk;" a flower fertilized in the latter manner would have yielded about 136 seed, and it may be observed that one such pod is missing, viz., at the bottom of compartment 1. Therefore I have hardly any doubt that I fertilized a flower marked with "white thread," as if it had been marked with "white silk." With respect to the capsule which yielded 92 seed, in the same column with that which yielded 136, I do not know what to think. I endeavoured to prevent pollen dropping from an upper to any lower flower, and I tried to remember to wipe the pincers carefully after each fertilization; but in making eighteen different crosses, sometimes on windy days, and pestered by bees and flies buzzing about, some few errors could hardly be avoided. One day I had to keep a third man by me all the time to prevent the bees visiting the uncovered plants, for in a few seconds' time they might have done irreparable mischief. It was also extremely difficult to exclude minute Diptera from the net. In 1862 I made the great mistake of placing a mid-styled and long-styled under the same huge net: in 1863 I avoided this error.

Table III.—Short-styled Form (*continued*).

| V.<br>10 flowers fertilized by *own* longer stamens. | | VI.<br>10 flowers fertilized by *own* shorter stamens. | |
|---|---|---|---|
| 0 | 0 | 64?[*] | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| — | 0 | — | 0 |
| 0 | 0 | 21 | 0 |
| 0 | | 9 | |
| Too sterile for any average. | | Too sterile for any average. | |

I fertilized a number of flowers without particular care with their own two pollens, but they did not produce a single capsule; the position of the stigma within the calyx renders the fertilization without some care difficult.

### *Summary of the three preceding Tables.*

*Long-styled form.*—Twenty-six flowers fertilized by the stamens of corresponding length, borne by the mid- and short-styled forms, yielded 61·5 per cent. of capsules, which contained, on an average, 89·7 seed.

Twenty-six flowers fertilized by the other and shorter stamens of the mid- and short-styled forms yielded only two very poor capsules.

Thirty flowers fertilized by this form's own two sets of stamens yielded only eight very poor capsules; but flowers well fertilized by bees by one or both of their own kinds of pollen produced numerous capsules containing, on an average, 21·5 seed.

*Short-styled form.*—Twenty-five flowers fertilized by the stamens of corresponding length, borne by the long- and mid-styled forms, yielded 72 per cent. of capsules, which (excluding one capsule with only nine seeds) contained, on an average, 70·8 seed.

Twenty flowers fertilized by the longer stamens of the long- and mid-styled forms yielded only two very poor capsules.

Twenty flowers fertilized by both their own two sets of stamens yielded only two poor (or perhaps three) capsules.

*Mid-styled form.*—Twenty-four flowers fertilized by the stamens of corresponding length, borne by the long- and short-styled forms, yielded 96 (probably 100) per cent. of capsules, which contained (excluding one capsule with 12 seed), on an average, 117·2 seed.

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[*] I suspect that, by mistake, I fertilized this flower with the pollen of the shorter stamens of the long-styled form, and it would then have yielded about 64 seed. Flowers to be thus fertilized were marked with black silk; those with the pollen of the shorter stamens of the short-styled with black thread; and thus, I suspect, the mistake arose.

Fifteen flowers fertilized by the longer stamens of the short-styled form yielded 93 per cent. of capsules, which (excluding four capsules with less than 20 seed) contained, on an average, 102·8 seed.

Thirteen flowers fertilized by the shorter stamens of the long-styled form yielded 54 per cent. of capsules, which capsules (excluding one with 19 seed) contained, on an average, 60·2 seed.

Twelve flowers fertilized by own longer stamens yielded 25 per cent. of capsules, which (excluding one with 9 seed) contained, on an average, 77·5 seed.

Twelve flowers fertilized by own shorter stamens yielded not a single capsule.

Considering the three Tables and this summary, we may safely draw the following conclusions. First, that, as in structure so in function, there are three females or female organs: this is manifest; for when all three receive the very same pollen, they are acted on most differently. So conversely with the thirty-six stamens, we know that they consist of three separate sets of a dozen each, differing in various respects; and in function the pollen of these three sets when applied to one and the same stigma acts most differently, as a glance at the Tables proves. But we shall presently see that the action of the pollen of the whole dozen longest and of the whole dozen shortest stamens is not identical.

Secondly, we see that only the longest stamens fully fertilize the longest pistil, the middle stamens the middle pistil, and the shortest stamens the shortest pistil. And now we can comprehend the meaning of the almost exact correspondence in length between the pistil of each form and the two half-dozen sets of stamens borne by the two other forms; for the stigma of each form is thus rubbed against the same spot of the insect's body, which becomes most charged with the proper pollen. In all three forms, the female organ is but feebly, or not at all, acted on by its own two kinds of pollen. In my papers on the dimorphism of *Primula* and *Linum*, I used the terms "heteromorphic" for the fully fertile unions between the female element of the one form and the male element of the other, and "homomorphic" for the less fertile or quite sterile unions between the female and male elements of the same form. The principle involved in these terms holds good with *Lythrum*, but is insufficient; for though in each of the three forms the fertile unions are all ***heteromorphic***, the appropriate pollen coming from the stamens of corresponding length borne by the other two forms, and though the *homomorphic* unions of the females with their own two sets of males are always more or less sterile, there remain in each case two other sterile unions, not included in these two terms. Hence it will be found convenient to designate the two unions of each female with the two sets of stamens of corresponding length, which are fully fertile, as *legitimate unions*, and the four other, more or less sterile, unions of each female with the four other sets of stamens as *illegitimate unions*. Consequently, of the eighteen possible unions between the three forms, six are legitimate and twelve are illegitimate.

Another and curious conclusion cannot be considered as proved, but is rendered highly probable, by the Tables. The unions of the pistils and stamens of equal length are alone fully fertile. Now with the several illegitimate unions it will be found that the greater the inequality in length between the pistil and stamens, the greater the sterility of the result. There is no exception to this rule. Thus, with the long-styled form, its own shorter stamens are far less equal in length to the pistil than its own longer stamens; and the capsules fertilized by the pollen of the shorter stamens yielded fewer seeds: the same comparative result follows from the use of the pollen of the shorter stamens of the mid-styled form, which are much shorter than the shorter stamens of the short-styled (see diagram), and therefore less equal in length to the long-styled pistil. We shall see exactly the same result if we look to the four illegitimate unions under the mid- and short-styled forms. Certainly the difference in sterility in these several cases is very slight, but the sterility always increases with the increasing inequality of length between the pistil and the stamens which are used. Therefore I believe in the above rule; but a vast number of artificial unions would be requisite to prove it. If the rule be true, we must look at it as an incidental and useless result of the gradational changes through which this species has passed in arriving at its present condition. On the other hand, the correspondence in length between the pistil of each form and those stamens which alone give full fertility is clearly of service to the species, and is probably the result of direct adaptation.

Some of the illegitimate unions yielded, as may be seen in the Tables, during neither year a single seed; but, judging from the case of the long-styled plant, it is probable, if such unions could be effected repeatedly under the most favourable conditions, some few seeds would be produced. Anyhow, I can state that in all the eighteen possible unions the pollen-tubes penetrated, after eighteen hours, the stigma. I have reason to believe that the offspring from the illegitimate unions present some singular characteristics; but until my observations on this head are repeated, I must be silent. At first I thought that perhaps two kinds of pollen placed together on the same stigma would give more fertility than any one kind; but we have seen that this is not the case with each form's own two kinds of pollen; nor is it probable in any case, as I occasionally got, by the use of single kinds of pollen, fully as many seed as I have seen in a capsule naturally fertilized. Moreover the proper pollen from a single anther is more than sufficient to fully fertilize each stigma; hence, in this as in so many other cases, at least twelve times as much of each kind of pollen is produced as is necessary to ensure full fertilization. From the dusted condition of the whole body of those bees which I caught on these flowers, it is probable that some pollen of all kinds is deposited on each stigma; but there can hardly be a doubt that the pollen of the stamens of corresponding length will be prepotent and will wholly obliterate any effect from the other kinds of pollen, even if previously deposited on the stigma. I infer this partly from the fact ascertained by Gärtner that each species' own pollen is so prepotent over that of any other species, that if put on the stigma many hours subsequently, it will entirely obliterate the action of the foreign pollen. But I draw the above inference especially from the following experiment: I fertilized homomorphically or illegitimately some long-styled Cowslip flowers (*Primula veris*) with their own pollen, and exactly twenty-four hours subsequently I fertilized these same stigmas heteromorphically or legitimately with pollen from a short-styled dark-red Polyanthus. I must premise that I have raised many seedlings from crossed Cowslips and Polyanthus, and know their peculiar appearance; and I further know, by the test of the fertility of the mongrels *inter se*, and with both parent forms, that the Polyanthus is a variety of the Cowslip, and not of the Primrose (*P. vulgaris*) as some authors have supposed. Now from the long-styled Cowslip twice fertilized in the manner explained, I raised twenty-nine seedlings, and every one of them had flowers coloured more or less red; so that the heteromorphic Polyanthus-pollen wholly obliterated the influence of the homomorphic pure Cowslip-pollen, which had been placed on the stigmas twenty-four hours previously, and not a single pure Cowslip was produced.

The last conclusion which may be deduced from the Tables, even from a glance at them, is that the mid-styled form differs from both the others in its much higher capacity for fertilization. Not only did the twenty-four flowers fertilized by the stamens of corresponding lengths, all, or all but one, yield capsules rich in seed; but of the other four illegitimate unions, that by the longer stamens of the short-styled form was highly fertile, though less than in the two legitimate unions, and that by the short stamens of the long-styled form was fertile to a considerable degree; the two unions with this form's own pollen were sterile, but in different degrees. So that the mid-styled form, when fertilized by the six kinds of pollen, evinces five different grades of fertility. By comparing compartments 3 and 6 in Table II. we learn a remarkable fact, namely, that though the pollen from the short stamens of the long-styled and from this form's own (mid-styled) short stamens, used in these two unions, is identical in all respects, yet that its action is widely different; in the one case above half the fertilized flowers yielded capsules containing a fair number of seed; in the other case not one single capsule was produced. So, again, the green, large-grained pollen from the long stamens of the short-styled and from this form's own (mid-styled) long stamens is identical in all respects, but its action, as may be seen in compartments 4 and 5, is widely different. In both these cases the difference in action is so plain that it cannot be mistaken, but it can be corroborated. If we look to Table III., to the legitimate action of the short stamens of the long- and mid-styled forms on the pistil of the short-styled form, we again see a similar but slighter difference, the pollen of the short stamens of the mid-styled form yielding a smaller average of seed during the two years of 1862 and 1863 than that from the short stamens of the long-styled form. Again, if we look to Table I., to the legitimate action of the green pollen of the two sets of long stamens, we shall find exactly the same result, viz. that the pollen of the long stamens of the mid-styled form yielded during both years fewer seeds than that from the long stamens from the short-styled form. Hence it is certain that the two kinds of pollen produced by the mid-styled form are less potent than the similar pollens produced by the corresponding stamens of the two other forms.

When we see that the capsules of the mid-styled form yield a considerably larger average number of seed than those of the other two forms,—when we see how surely the flowers are fertilized in the legitimate unions, and how much more productive the illegitimate unions are than those of the other two forms, we are led to consider the mid-styled form as eminently feminine in its nature. And although it is impossible to consider as rudimentary or aborted the two perfectly developed sets of stamens of the mid-styled form which produce an abundance of perfectly well-developed pollen, yet we can hardly avoid connecting, as balanced, the higher efficiency of the female organ with the lesser potency of the two mid-styled pollens.

Finally, it is proved by the Tables that *Lythrum salicaria* habitually produces or consists of three females different in structure and widely different in function; that it produces or consists of three sets of males widely different in structure and function; and that two of the three sets of males are subdivided into subgroups of half a dozen each, differing in a marked manner in potency, so that regularly five kinds of pollen are elaborated by this one species of *Lythrum*.

*Lythrum Græfferi.*—I must now say a few words about some of the other species of the genus. I have examined numerous dried flowers of *L. Græfferi*, each from a separate plant, kindly sent me from Kew. This species, like *L. salicaria*, is trimorphic, and the three forms apparently occur in about equal numbers. In the long-styled form the pistil projects about one-third of the length of the calyx beyond its mouth, and is therefore shorter than in *L. salicaria*; the globose and hirsute stigma is larger than that of the other two forms; the longer stamens, which are graduated in length, have their anthers standing just above and just beneath the mouth of the calyx; the half-dozen shorter stamens rise rather above the middle of the calyx. In the mid-styled form the stigma projects just above the mouth of the calyx, and stands almost on a level with the longer stamens of the previous form; its own longer stamens project well above the mouth of the calyx and stand a little above the level of the stigma of the long-styled form; the shorter stamens correspond in all respects with the shorter ones in the previous form. In the short-styled form the stigma of the pistil is nearly on a level with the anthers of the shorter stamens in the two preceding forms; and the longer stamens correspond with the longer stamens of the mid-styled form, and the shorter stamens with the longer stamens of the long-styled form. In short, there is a close general correspondence in structure between this species and *L. salicaria*, but with some differences in the proportional lengths of the parts. Nevertheless the fact of each of the three pistils having two sets of stamens, borne by the two other forms, of corresponding lengths, comes out conspicuously. In the mid-styled form the distended pollen-grains from the longer stamens had nearly double the diameter of those from the shorter stamens; so that there is a greater difference in this respect than in *L. salicaria.* In the long-styled form, also, the difference in diameter between the pollen-grains of the longer and shorter stamens was plainer than in *L. salicaria.* These comparisons, however, must be received with caution, as they were made on specimens long kept in a dried condition.

*Lythrum thymifolia.*—This form, according to Vaucher*, is dimorphic like *Primula*, and therefore presents only two forms. I received two dried flowers from Kew, which presented two forms: in the one form the stigma projected far beyond the calyx, in the other it was included within the calyx; in this latter form the style was only one-fourth of the length of the style of the other form. There are only six stamens; these are somewhat graduated in length, and in the short-styled form the anthers stand a little above the stigma, but yet the stamens by no means equal in length the pistil of the long-styled form; in the long-styled form the stamens are rather shorter than in the other form. These six stamens alternate with the petals, and correspond homologically with the longer stamens of *L. salicaria* and *L. Græfferi.* As there are only six stamens, it is scarcely possible that this species can be trimorphic.

*Lythrum hyssopifolia.*—This species is said by Vaucher, but I believe erroneously, to be dimorphic. I have examined dried flowers from twenty-two separate plants from various localities, kindly sent to me by Mr. Hewett C. Watson, Prof. Babington, and others. These were all essentially alike. Hence the species cannot be dimorphic. The pistil varies somewhat in length, but when unusually long the stamens are likewise generally long; in the bud the stamens are short: perhaps these circumstances deceived Vaucher. There are from six to nine stamens, graduated in length; the stamens which are variable in being present or absent correspond with the six shorter stamens of *L. salicaria* and with the six which are absent in *L. thymifolia.* The stigma is included within the calyx, and stands in the midst of the anthers, and would generally be fertilized by them; but as the stigma and anthers are upturned, and as, according to Vaucher, there is a passage left in the upper side of the flower to the nectary, there can hardly be a doubt that the flowers are visited by insects, which would occasionally bring pollen from other flowers of the same or of any adjoining plant, as surely as occurs with the short-styled *L. salicaria*, of which the pistil and corresponding stamens closely resemble those of *L. hyssopifolia*. According to Vaucher and Lecoq*, this species, which is an annual, generally grows almost solitarily, whereas the three preceding species are social; and this alone would almost have convinced me that *L. hyssopifolia* cannot be dimorphic, as such plants cannot habitually live by themselves any better than one sex of a diœcious species.

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* Hist. Phys. des Plantes d'Europe, tom. ii. (1841) pp. 369, 371.

*Nesæa verticillata*.—I raised a number of plants from seed sent me by Professor Asa Gray, and they presented three forms. These differed from each other in the proportional lengths of their organs of fructification and in all respects in very nearly the same way as the three forms of *Lythrum Græfferi*. The green pollen-grains from the longest stamens, measured along their greater axis and not distended with water, were $\frac{13}{7000}$ of an inch in length; those from the stamens of middle length $\frac{9\text{-}10}{7000}$, and those from the shortest stamens $\frac{8\text{-}9}{7000}$ of an inch.

We have seen that the genus *Lythrum* affords trimorphic, dimorphic, and monomorphic species.

The inquiry naturally arises, why do these species differ so remarkably in their sexual relations? of what service can reciprocal dimorphism or trimorphism be to certain species, whilst other species of the same genus present, like the great majority of plants, only one form? I have elsewhere given too briefly† the general grounds of my belief that with all organic beings distinct individuals at least occasionally cross together, and reciprocal dimorphism is plainly one most efficient means for ensuring this result.

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* Géograph. Bot. de l'Europe, tom. vi. (1857) p. 157.

† 'Origin of Species,' 3rd edit., p. 101. Hugo von Mohl has recently (Bot. Zeitung, 1863, S. 309, 321), in a most interesting paper, advanced the case of the minute, imperfectly developed, closed and self-fertile flowers borne by *Viola*, *Oxalis*, *Impatiens*, *Campanula*, &c., as an argument against my doctrine that no species is self-fertilized for perpetuity. I may state that in the spring of 1862 I examined some of these flowers, and saw, though less thoroughly, all that H. von Mohl has so well described. I can add only one remark, which I believe is correct, that in *V. canina* there is an open channel for the pollen-tubes from the extremity of the stigma to the ovarium; for I gently pressed a minute bubble of air repeatedly backwards and forwards from end to end. Though the imperfectly developed and the perfect flowers are so different in structure, it is a rather curious case of correlation, that in the double purple Violet (*V. odorata*) the minute imperfect flowers are double to the very core, so that a section appears like the head of a cabbage when cut through. There can be, as von Mohl asserts, no doubt that these flowers are always self-fertilized; they are moreover specially adapted for this end, as may be seen in the remarkable difference in the shape of the pistil in *V. canina* (and in a less degree in *V. hirta* and the single *V. odorata*) as compared with that of the perfect flower;

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and in the pollen-tubes which proceed from the grains within the anthers in *V. canina*, and from within the lower anthers of *Oxalis acetosella*, having the wonderful power of directing their course to the stigma. If these plants had produced the minute closed flowers alone, the proof would have been perfect that they could never have crossed with other individuals. I am aware that in some of these cases it has been stated that the perfect flowers never produce any seed; as far as *Amphicarpæa* is concerned, I hear from Professor Asa Gray that the petaliferous flowers certainly sometimes yield seed. The completely enclosed flowers of that curious grass, the *Leersia oryzoides*, as described by M. Duval-Jouve (Bull. Soc. Bot. de France, tom. x. 1863, p. 194), apparently offer the best case of perpetual self-fertilization; for when perfect flowers are protruded from the culms, they are, as far as is yet known, always sterile. In a number of plants kept by me in pots in water, not one single perfect flower has protruded, but the enclosed flowers produced plenty of seed. Without wishing to throw any doubt on M. Duval-Jouve's excellent observations, I may add that with the enclosed flowers borne by my plants, the act of fertilization, that is, the penetration of the stigma by the pollen-tubes, took place in the air and not in fluid within the glumes. With the exception of the *Leersia*, as the case now stands, I cannot see how the production of the small, imperfect flowers invalidates my doctrine that no species is perpetually self-fertilized, more than the multiplication of many plants by bulbs, stolons, &c. As I observe that the production of seed by the perfect flowers of *Viola* is spoken of as something capricious and accidental, I may state that, although it varies much in different years, it depends exclusively on the visits of bees; I ascertained this by marking many flowers thus visited, and finding that they produced capsules, and by covering up many flowers which (excepting a few that I artificially fertilized) did not, when thus protected, produce a single capsule. After bees have visited these flowers, the pollen may be seen scattered on the papillæ and on the stigma itself, and they can hardly fail thus to cross distinct individuals. These remarks apply to *V. canina*, *hirta*, and *odorata*; with *V. tricolor* the case is somewhat different; but I must not enlarge any more on this subject. The production by so many plants of perfect and expanded, as well as of imperfect and closed flowers, seems to me to throw much light on many points; it shows how extraordinarily little pollen is necessary for full fertilization, for I ascertained with *V. canina* that the perfect and imperfect flowers (the latter producing so few pollen-grains) yielded the same average number of seeds; it shows us that fertilization can be perfected in closed flowers; it shows us that large, highly coloured petals, perfume, and the secretion of nectar are by no means indispensable for this act, even in those species which properly possess these characters. It seems to me that the necessity of an occasional cross with a distinct individual of the same species explains the universal presence of at least some expanded flowers, at the expense of injury from rain and the loss of much pollen by innumerable pollen-robbing insects; it explains the enormous superfluity of pollen from its liability to loss from these causes and during conveyance from flower to flower; it explains the use of a gaily coloured corolla, perfume, and nectar, namely, to attract insects, except in those comparatively few cases in which wind is the agent, and in these the last-named attributes are deficient.

This result would appear to be one of high importance, for with dimorphic plants it is ensured at the risk of occasional sterility; not only is the pollen of each plant useless or nearly useless to that individual, but so is the pollen of all the plants of the same form, that is, of half the total number of individual plants. In that extensive class of plants called by C. K. Sprengel dichogams, in which the pollen of each flower is shed before its own stigma is ready, or in which the stigma (though this case occurs more rarely) is mature before the flower's own pollen is ready sterility can hardly fail to be the occasional result; and it would be the inevitable result with both dichogamous and reciprocally dimorphic flowers unless pollen were carried by insects (and in some few species by the wind) from one flower or plant to the other. As with reciprocal dimorphism so with dichogamy, within the same genus some of the species are and some are not thus characterized. Again, in the same genus, as in that of *Trifolium*, some species absolutely require insect-aid to produce seed, others are fertile without any such aid; now when insects are requisite for fertilization, pollen will generally be carried from one flower to the other. We thus see, by means of reciprocal dimorphism, of dichogamy, and of insect-aid, that some species require, or at least receive, incessant crosses with other individuals of the same species; whereas other species of the same genera can be, and probably are often fertilized during long periods by the pollen of their own flowers. Why this wide difference in the frequency of crosses should occur we are profoundly ignorant. I will only further remark on this head, that it would be a great mistake to suppose that many flowers, which are neither reciprocally dimorphic nor dichogamous, nor require insect-aid for their fertilization, nor show any particular adaptation in their structure for the visits of insects, are not habitually crossed with the pollen of other individuals; this occurs, for instance, habitually with cabbages, radishes, and onions, which nevertheless are perfectly fertile (as I know by trial) with their own pollen without aid of any kind.

But it may be further asked, granting that reciprocal dimorphism is of service by ensuring at each generation a cross (but I am far from pretending that it may not have some additional unknown signification), why did not dimorphism suffice for *L. salicaria* and *Græfferi*? why were they rendered reciprocally trimorphic, entailing such complicated sexual relations? We cannot answer, except perhaps so far:—if we suppose two plants of the *L. salicaria* to grow by themselves, then if the species were dimorphic it would only be an equal chance in favour of the two turning out different forms and consequently both being fertile; but as the species is trimorphic and each form can fertilize the two other forms, it is two to one in favour of the two turning out different forms and being consequently both fertile. We thus see how reciprocal trimorphism must be an advantage; and probably it would be more advantageous to this Lythrum, which commonly grows in almost a single row along the banks of streams, than it would be to Primroses or Cowslips which have neighbours on all sides. But even if trimorphism effected no good beyond that gained by dimorphism, we ought not to feel much surprised at its occurrence, for we continually see throughout nature the same end gained by the most complicated as well as by the most simple means: to give one instance:—in many diœcious plants pollen is carried from the male to the female by the wind, which is perhaps the simplest method conceivable, or by the adherence of the grains to the hairy bodies of insects, which is a method only a little less simple; but in *Catasetum* the conveyance is effected by the most complex machinery; for in this orchid we have sensitive horns which when touched cause a membrane to rupture, and this sets free certain springs by which the pollen-masses are shot forth like an arrow, and they adhere to the insect's body by a peculiar viscid matter, and then by the breaking of an elastic thread of the right strength the pollen is left sticking to the stigma of the female plant. The complexity of the means used in this and in many other cases, in fact depends on all the previous stages through which the species has passed, and on the successive adaptations of each part during each stage to changed conditions of life.

As some authors consider reciprocal dimorphism to be the first step towards diœciousness, the difficulty of understanding how a trimorphic plant like *Lythrum salicaria* could become diœcious should be noticed; and as dimorphism and trimorphism are so closely allied, it is not probable that either state is necessarily in any way related to a separation of the sexes—though it may occasionally lead to this end. As far as *Lythrum salicaria* is concerned, the one tendency which we can discover is towards the abortion of the two sets of stamens in the mid-styled form. This tendency is evinced by its pollen, though abundant and apparently good, yielding a smaller percentage of seed than does the pollen of the corresponding stamens in the other two forms; and this fact is in itself curious, and shows by what insensibly graduated steps nature moves. If this tendency were carried out the mid-styled form would become a female, depending for its fertilization on two sets of stamens in the long- and short-styled forms; and these two forms would reciprocally fertilize each other like the two forms of *Primula* or *Linum*; but there would be no approach to a diœcious condition.

As the case of the trimorphic species of *Lythrum* is so complicated, and as it is easier to perceive the relations of the sexes in the animal than in the vegetable kingdom, it may be worth while to give, before concluding, a somewhat elaborate simile. We may take the case of a species of Ant, and suppose all the individuals invariably to live in three kinds of communities; in the first, a large-sized female (not to specify other differences) living with six middle-sized and six small-sized males; in the second, a middle-sized female with six large- and six small-sized males; and in the third community, a small-sized female with six large- and six middle-sized males. Each one of these three females, though enabled to unite with any male, would be nearly sterile with her own two sets of males, and likewise with two other sets of males living in the other two communities; for she would be fully fertile only when paired with a male of her own size. Hence the thirty-six males, distributed by half-dozens in the three communities, would be divided into three sets of a dozen each; and these sets, as well as the three females, would differ from each other sexually in exactly the same manner as distinct species of the same genus. Moreover the two sets of males living in the community of the extraordinarily fertile middle-sized female would be less potent sexually than the males of corresponding size in the two other communities. Lastly, we should find that from the eggs laid by each of the three females, all three sorts of females and all three sorts of males were habitually reared—proving to demonstration that all belonged to one and the same species.

To appreciate fully this remarkable case of the reciprocally trimorphic species of *Lythrum*, we may take a glance at the two great kingdoms of nature and search for anything analogous. With animals we have the most astonishing diversity of structure in the so-called cases of alternate generation, but as such animals have not arrived at maturity, they are not properly comparable with the forms of *Lythrum*. With mature animals we have extreme differences in structure in the two sexes; we have in some of the lower animals males, females, and hermaphrodites of the same species; we have the somewhat more curious case of certain Cirripedes which are hermaphrodites, but are sexually aided by whole clusters of what I have called complemental males; we have, as Mr. Wallace has lately shown, the females of certain Lepidoptera existing under three distinct forms; but in none of these cases is there any reason to suspect that there is more than one female or one male sexual element. With certain insects, as with Ants, in which there exist, besides males and females, two or three castes of workers, we have a slightly nearer approach to our case, for the workers are so far sexually affected as to have been rendered sterile. With plants, at least with phanerogamic plants, we have not that wonderful series of successive developmental forms so common with animals; nor could this be expected, as plants are fixed to one spot from their birth, and must be adapted throughout life to the same conditions. With plants we have sexual differences in structure, but apparently less strongly marked than with animals, from causes which are in part intelligible, such as there being no sexual selection; again, we have that class of dimorphic flowers so ably discussed recently by Hugo von Mohl, in which some of the flowers are minute, imperfectly developed, and necessarily self-fertile, whilst others are perfect and capable of crossing with other flowers of the same species; but in these several cases we have no reason to suspect that there is more than one female or one male sexual element. When we come to the class of reciprocally dimorphic plants, such as *Primula*, *Linum*, &c., we first meet with two masculine and two feminine sexes. But these cases, which seemed only a short time since so strange, now sink almost into insignificance before that of the trimorphic species of *Lythrum*.

Naturalists are so much accustomed to behold great diversities of structure associated with the two sexes, that they feel no surprise at the fact; but differences in sexual nature have been thought to be the very touchstone of specific distinction. We now see that such sexual differences—the greater or less power of fertilizing and being fertilized—may characterize and keep separate the coexisting individuals of the same species, in the same manner as they characterize and have kept separate those groups of individuals, produced from common parents during the lapse of ages or in different regions, which we rank and denominate as distinct species.

# Notes on the Sterility and Hybridization of certain Species of *Passiflora*, *Disemma*, and *Tacsonia*. By Mr. JOHN SCOTT. Communicated by C. DARWIN, Esq., F.R.S. & L.S.

[Read June 16, 1864.]

IN the Royal Botanic Gardens of Edinburgh, plants of the *Passiflora racemosa*, *cærulea*, and *alata* have been grown for a number of years; yet Mr. M'Nab has informed me that, though annually yielding a profusion of blooms, he has never known them to produce a single seed. That this sterility originates in the impotent action of the male and female sexual elements on each other, and not merely, as might be suspected, from the pollen not reaching the stigmas, I have fully satisfied myself by continued experiments throughout the flowering seasons of 1861 and 1862. During both seasons I fertilized on each plant of the above-named species a vast number of flowers with their own pollen, but not one of them produced a single seed. I may also state, as further confirmatory of the functional impotence of at least *P. racemosa* and *P. alata*, that similar experiments have been made by one or two other young men in the Botanic Gardens with the same result. In one or two instances, indeed, in our experiments on *P. racemosa* fruits were produced; but these proved destitute of seed, the walls of the ovaries being alone developed.

A similar inveterate self-sterility in plants of the above species has been frequently noticed; and in one or two instances it has been found (but I have no books at hand for reference) that, though thus utterly impregnable to their own pollen, they are nevertheless susceptible to fertilization by that of certain allied species, while the potency of their own pollen has been proved by its effectively fertilizing other species. Accordingly, in 1863, I again instituted a series of experiments on these plants of the *Passiflora racemosa*, *cærulea*, and *alata*, in the Botanic Gardens of Edinburgh, by way of eliciting the nature of their sterility, and proving whether or not they were susceptible to reciprocal fertilization with other individuals of the same, or of allied species. The results of these experiments are so curious, that I think it will be worth while to communicate them to the Society in detail; they are as follows*.

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* I am greatly indebted to Mr. J. B. Sterling for giving me pollen from a plant of the *P. alata* in the nurseries of the Messrs. Lawson and Sons, Edinburgh; and for trying experiments on this plant with its own pollen and with that of other species. I have also to express my thanks to a gentleman at

1. First for *P. racemosa* as female.—I placed pollen of the *P. alata* No. 1 upon the stigmas of ten flowers of the *P. racemosa*; seven of these set, but four of them only reached maturity, and yielded an average of 123 apparently good seeds per fruit, while the others dropped off early and contained no good seeds. Four flowers on the *P. racemosa* fertilized with pollen of the *P. alata* No. 2 resulted differently, as the ovary of not even one swelled. Again, six flowers on the *P. racemosa* fertilized with pollen of the *P. alata* No. 3 produced three fruits, two of which shanked off while the other ultimately maturing yielded 114 apparently good seeds.

By applying pollen of *P. cærulea* No. 1 to the stigmas of six flowers of the *P. racemosa*, I obtained two fruits; these contained 235 seeds, of which 197 were apparently good. Pollen of *P. cærulea* No. 2 applied to the stigmas of eight flowers of the *P. racemosa* failed to effect the swelling of even one germen. I had ultimately similar results by placing pollen of the *P. cærulea* No. 3 upon the stigmas of eight flowers of the *P. racemosa*, though I had hopes of a different result from the early swelling of three germens, but these shanked off. By applying pollen of *P. edulis* to the stigmas of six flowers of *P. racemosa*, one ovary alone swelled, but this dropped off prematurely and contained no good seeds. Again, experiments on *P. racemosa* with pollen of the *Tacsonia pinnatistipula* resulted in the abortion of all the ovaries: but I was more successful in my experiments with *P. racemosa* and *T. mollissima*, inasmuch as from six flowers of the former fertilized by pollen of the latter I got three ovaries to swell; one of these alone matured, and yielded 142 seeds, of which 22 seemed good. Lastly, I fertilized 20 flowers on the *P. racemosa* with own pollen: though, as we have above shown, it

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Keith Hall, Perthshire, for sending me pollen from plants of the *P. alata* and *P. cærulea*, and likewise for trying experiments on the former species with pollen from another individual which I sent him. The results of these experiments will be given in the sequel. For the sake of brevity, however, I will here affix numbers to each of the plants of the *P. alata* and *cærulea* experimented upon, so that I may not have further occasion for noticing the particular plant of which I may be treating; thus, *P. cærulea*, Nos. 1 & 2, refer to plants growing in the Botanic Gardens of Edinburgh; *P. cærulea*, No. 3, to a plant growing in the gardens, Keith Hall; *P. alata*, No. 1, plant growing in the Botanic Gardens, Edinburgh; *P. alata*, No. 2, plant growing in the gardens, Keith Hall; *P. alata*, No. 3, plant growing in the nurseries of the Messrs. Lawson and Sons, Edinburgh.

is perfectly susceptible of fertilization with the pollen of other species, one of these ovaries alone set, and this proved utterly void of seeds.

2. *P. cærulea* No. 1 as female.—I placed pollen of *P. cærulea* No. 2 upon the stigmas of four flowers of *P. cærulea* No. 1, and the ovaries of two of these swelled slightly, but they ultimately shanked without yielding any seed. I had more successful results with pollen of *P. cærulea* No. 3 upon the stigmas of *P. cærulea* No. 1, as, from four flowers thus treated, three ovaries set, of which only one shanked off, while the others, fully maturing, yielded conjointly 237 apparently good seeds. I also succeeded in fertilizing *P. cærulea* No. 1 with pollen of *P. racemosa*, as six flowers thus treated produced three ovaries; of these two shanked off, only one maturing; this yielded 115 seeds, of which 87 were to all appearance good. Again, by applying pollen of *P. alata* No. 1 to the stigmas of *P. cærulea* No. 1, the fruits in every case aborted; and so in experiments on *P. cærulea* No. 1 with pollen of *P. edulis*, the ovaries of not even one swelled. Lastly, I fertilized twelve flowers of the *P. cærulea* No. 1 with own pollen, but all of them dropped off without effecting the slightest development of a single ovary.

3. *P. cærulea* No. 2 as female.—I placed pollen of *P. cærulea* No. 1 upon the stigmas of four flowers of the *P. cærulea* No. 2, and thus got three ovaries to set; of these two shanked off; the other, maturing, contained 154 seeds, of which 143 seemed to be good. Again, from four flowers of the *P. cærulea* No. 2 fertilized with pollen of the *P. cærulea* No. 3, I obtained three fruits, and these yielded in all 293 seeds, of which 262 were good. I also succeeded in fertilizing *P. cærulea* No. 2 with pollen of the *P. racemosa*, as, from three flowers thus treated, I obtained one fine plump fruit; this contained 105 seeds, of which 68 were apparently good. Again, by placing pollen of *P. alata* No. 1 upon the stigmas of four flowers of the *P. cærulea* No. 2, I got one ovary to set; this, however, dropped off prematurely and contained no good seed. Lastly, on *P. cærulea* No. 2 I impregnated eight flowers with own pollen; the results, however, in accordance with my previous experiments, showed that this plant, though susceptible to fertilization by pollen of other individuals of the same species, and also by that of other species, was nevertheless utterly impregnable to its own pollen, as all the flowers thus treated dropped off without effecting the setting even of a single ovary.

4. I placed pollen of the *P. alata* No. 2 upon the stigmas of

eight flowers of the *P. alata* No. 1. The ovaries of four of these swelled for some time, but ultimately one of them shanked off, while the other three reached perfection and yielded in all 674 seeds, of which 560 appeared to be good. By the converse experiment the results were very different; thus, four flowers of the *P. alata* No. 2 were impregnated with pollen of the *P. alata* No. 1, but each of these dropped off, without affording the slightest symptoms of fertilization. Again, on the *P. alata* No. 1 I fertilized six flowers with pollen of *P. alata* No. 3; but though the ovaries of two of these set, and continued swelling for some time, they ultimately dropped prematurely and did not yield any good seed. I also had in this case the converse experiment tried for me, and from four flowers on the *P. alata* No. 3 fertilized with pollen of the *P. alata* No. 1, one ovary was induced to set; but, as in the converse case, this did not continue to swell. Seeing, however, that in either of these cases so few flowers were experimented upon, we may, I think, with justice be permitted to infer from the results that more extended experiments would show them capable of reciprocally fertilizing each other. I dissected some flowers of these three plants of *P. alata* which had been treated with each other's pollen, and found the stigmas abundantly penetrated by pollen-tubes. This fact, together with the swelling of the ovaries, shows a much higher degree of reciprocal susceptibility to each other's pollen than exists (as we shall presently see) in any one of these plants when fertilized with pollen from the same individual plant.

The following results of experiments on the *P. alata* No. 1 as female with pollen of other species may also be worthy of notice in this place, from the fact that similar or reciprocal unions have been effected by different experimentors; and, further, that in at least one of the cases to be mentioned—that of *P. alata* No. 1 by pollen of *P. racemosa*—I have found, as above shown, that fertile unions may be readily effected, while the others, either directly or indirectly, dovetail themselves into each other by curious and complex fertile conjunctions, as will be found by a careful study of my experiments as detailed. First, I placed pollen of *P. racemosa* on the stigmas of ten flowers of the *P. alata* No. 1, but these all dropped off, without so much as the ovary of one swelling. Secondly, sixteen flowers on the *P. alata* No. 1 were impregnated with pollen from the plants Nos. 1 & 2 of *P. cærulea*, but in these cases also every ovary aborted. Thirdly, in the case of *P. alata* No. 1 by pollen of *P. edulis* the results were not materially different, as from six flowers thus treated one ovary alone set, but this did not continue swelling. Fourthly, six flowers of *P. alata* No. 1 proved impregnable to pollen of *Tacsonia mollissima*, while a similar number of flowers on the former fertilized with pollen of the *Tacsonia pinnatistipula* differed simply in the early setting of two of their ovaries, as neither continued swelling. Lastly, I applied pollen of the *Disemma Adiantoides* to the stigmas of six flowers of the *P. alata* No. 1, but this also proved ineffective, as the ovaries of not even one set.

With respect to the power of self-fertilization in the above three plants of *P. alata*, I may state that there is absolute impotence. I have already adduced evidence of this in *P. alata* No. 1 from experiments in the flowering seasons of 1861 and 1862. I repeated these in 1863 with similar results, as, from 20 flowers fertilized with own pollen, not one ovary exhibited the slightest symptoms of pollinic influence. On the plant of *P. alata* No. 2 a vast number of flowers have been from time to time fertilized, but the results showed a most inveterate self-sterility in the invariable abortion of every ovary. Again, experiments on the susceptibility of *P. alata* No. 3 to fertilization by its own pollen resulted also, according to Mr. Sterling, in the continued abortion of the ovaries. I have already stated, in previously giving the experiments on the reciprocal fertilization of *P. alata* Nos. 1 & 2, that the pollen of either, on being applied to the other's stigmas, produces pollen-tubes which freely penetrate their stigmatic tissues. In the action, however, of either stigma on its own pollen there is this material difference, that though it occasionally excites the development of the pollen-tubes, it is rarely penetrated by them.

Though the pollen of each of these plants of *P. alata* is thus utterly impotent on its own stigma, we have nevertheless shown it to be perfectly good in its relations with other individuals of the same species or with distinct species. As further illustrative, however, of the potency of the pollen of one of the above plants, I will here give the results of experiments with it on the stigmas of the *Disemma Adiantoides* and *coccinea*, both of which are also easily fertilized with their own pollen. Thus, on *D. Adiantoides* I fertilized three flowers by own pollen; each of these set, and produced fine plump ovaries, which yielded conjointly 720 good seeds. By applying pollen of *P. alata* No. 1 to six flowers of *D. Adiantoides*, I got four ovaries to set; two of these came to perfection and conjointly yielded 258 seeds, of which 46, judging from external appearance, were good. Again, three flowers on the *D. coccinea* fertilized by own pollen produced three fine fruits and 586 good seeds. On the stigmas of six other flowers of *D. coccinea* I placed pollen of the *P. alata* No. 1, and got two ovaries to set, but only one continued swelling, and yielded in all 74 seeds, of which only 12 were plump and apparently good.

5. In the Royal Botanic Gardens of Edinburgh there are, besides these perfectly self-sterile individuals already noticed, plants of two other species of *Passiflora* worthy of a passing notice from a similar inveterate self-sterility. These are the *P. holosericea* and *P. manora*. First, for their reciprocal fertilization, I placed pollen of *P. manora* upon the stigmas of ten flowers of the *P. holosericea*; the ovaries of seven of these set, and ultimately produced, in so far as could be judged from the plump, round, palish-yellow ovaries, perfect fruits. On dissecting these, however, I was disappointed to find that the walls of the ovary had alone been developed, and that they were all destitute of aught but the veriest rudiments of seeds. I have frequently repeated this experiment, and in every instance I found that the development of the ovaria of the *P. holosericea* may thus be readily effected by the pollen of the *P. manora*, whereas it is utterly impotent in exciting the slightest development of the seeds. I likewise tried the converse experiment, and applied pollen of *P. holosericea* to the stigmas of ten flowers of the *P. manora*; of these only one ovary set, but this soon shanked off. Though I have frequently repeated this experiment, I have not again got a single ovary to set. Again, with respect to the fertilization of these species with own pollen, I may state generally that though I have thus fertilized a vast number of flowers on both plants in the successive flowering seasons of 1862 and 1863, yet in no instance did a single fruit set. I also examined the stigmas of several flowers on both plants after the application of own pollen, and invariably found that the stigmas had failed to excite the development of a single pollen-tube. On the other hand, pollen of the *P. manora* readily protrudes its tubes when placed on the stigmas of *P. holosericea*, though, as we have shown, it utterly fails in effecting the vitalization or even development of the seeds. In the converse experiments I also examined the stigmas of *P. manora* after being covered with the pollen of *P. holosericea*, and in several instances found the pollen-tubes protruding and penetrating the stigmas, though, as we have seen, they fail to effect a fertilizing influence.

6. Lastly, I have to notice the results of experiments on plants of the *Tacsonia pinnatistipula* and *mollissima* growing in the Royal Botanic Gardens of Edinburgh. It had been observed that the plant of the *T. pinnatistipula*, though annually producing a profusion of blooms, rarely produced a single fruit; and, further, that when the latter were produced the seeds were always imperfect. It thus became the subject of the following experiments. In 1862 between 100 and 200 flowers were fertilized with own pollen, yet from these only three ovaries swelled; one dropped off prematurely; the two others came to perfection, forming large, plump, orange-like fruits. On cutting these open, I found in them an abundance of seeds; but these proved all imperfect, as on examination they were found destitute alike of embryo and surrounding albuminous matter, the hard sculptured spermoderms having alone been developed. From this sterility to own pollinic influence, I determined to try these flowers with pollen of other species. Accordingly, in 1863, I placed pollen of *T. mollissima* on the stigmas of six flowers of the *T. pinnatistipula*; of these three set fruits, but two of them shanked off; the one which came to perfection contained 190 seeds, of which 52 were embryonated. I likewise tried the converse experiment, and placed pollen of the *T. pinnatistipula* on six flowers of the *T. mollissima*, and thus got three ovaries to set; one of these was entirely destitute of seeds, while the others conjointly yielded 116 seeds, but these were all small and imperfectly developed.

From the results of experiments in 1862, we have seen that the *Tacsonia pinnatistipula* could not be impregnated with its own pollen. Nevertheless, from the above favourable results with pollen of the *T. mollissima*, I determined to again test its impotence with its own pollen, which is known to be good when applied to another species. I accordingly fertilized ten flowers with own pollen; but the results simply confirmed those derived from previous experiments, as the ovaries of not even one swelled. With respect to the self-fertility of the *T. mollissima* the case is very different, as I have found it fruit freely when treated with own pollen, and, further, that these fruits yield an abundance of good embryonated seeds.

There is another point here worthy of a passing notice. In the above experiments on *Passiflora racemosa* as female, we have seen that this species is susceptible of fertilization by the pollen of *Tacsonia mollissima*. In the converse experiment, however, the results are different, the pollen of *P. racemosa* proving utterly

## TABLE OF PURE AND MIXED UNIONS OF SPECIES OF *PASSIFLORA*, *DISEMMA*, AND *TACSONIA*.

| | Total number of flowers fertilized. | Total number of ovaries produced. | No. of ovaries which dropped prematurely. | Number of good ovaries. | Total number of seeds. | Number of apparently good seeds. |
|---|---|---|---|---|---|---|
| 1. Passiflora racemosa by pollen of P. cærulea No. 3 | 8 | 3 | 3 | ... | ...... | ...... |
| 2. Passiflora racemosa by pollen of P. cærulea No. 1 | 6 | 3 | 1 | 2 | 235 | 197 |
| 3. Passiflora cærulea No. 1 by pollen of P. racemosa | 6 | 3 | 2 | 1 | 115 | 87 |
| 4. Passiflora racemosa by pollen of P. cærulea No. 2 | 8 | 0 | ... | ... | ...... | ...... |
| 5. Passiflora cærulea No. 2 by pollen of P. racemosa | 3 | 1 | ... | 1 | 105 | 68 |
| 6. Passiflora racemosa by pollen of Tacsonia mollissima | 6 | 3 | 2 | 1 | 142 | 22 |
| 7. Tacsonia mollissima by pollen of Passiflora racemosa | 6 | 0 | ... | ... | ...... | ...... |
| 8. Passiflora racemosa by pollen of P. alata No. 1 | 10 | 7 | 3 | 4 | 784 | 512 |
| 9. Passiflora alata No. 1 by pollen of P. racemosa | 10 | 0 | ... | ... | ...... | ...... |
| 10. Passiflora racemosa by pollen of P. alata No. 3 | 6 | 3 | 2 | 1 | 158 | 114 |
| 11. Passiflora cærulea No. 1 by pollen of P. cærulea No. 2 | 4 | 2 | 2 | ... | ...... | ...... |
| 12. Passiflora cærulea No. 2 by pollen of P. cærulea No. 1 | 4 | 3 | 2 | 1 | 154 | 143 |
| 13. Passiflora cærulea No. 1 by pollen of P. cærulea No. 3 | 4 | 3 | 1 | 2 | 243 | 237 |
| 14. Passiflora cærulea No. 2 by pollen of P. cærulea No. 3 | 4 | 3 | ... | 3 | 293 | 262 |
| 15. Passiflora alata No. 1 by pollen of P. alata No. 2 | 8 | | 1 | 3 | 674 | 560 |
| 16. Passiflora alata No. 2 by pollen of P. alata No. 1 | 4 | ... | ... | ... | ...... | ...... |
| 17. Passiflora alata No. 1 by pollen of P. alata No. 3 | 6 | 2 | 2 | ... | ...... | ...... |
| 18. Passiflora alata No. 3 by pollen of P. alata No. 1 | 4 | 1 | 1 | ... | ...... | ...... |
| 19. Passiflora alata No. 1 by pollen of Disemma Adiantoides | 6 | ... | ... | ... | ...... | ...... |
| 20. Disemma Adiantoides by pollen of Passiflora alata No. 1 | 6 | 4 | 2 | 2 | 258 | 46 |
| 21. Disemma Adiantoides by own pollen | 3 | 3 | ... | 3 | 731 | 720 |
| 22. Disemma coccinea by pollen of Passiflora alata No. 1 | 6 | 2 | 1 | 1 | 74 | 12 |
| 23. Disemma coccinea by own pollen | 3 | 3 | ... | 3 | 596 | 586 |
| 24. Passiflora holosericea by pollen of P. manora | 10 | 7 | ... | 7 | no seeds. | |
| 25. Passiflora manora by pollen of P. holosericea | 10 | 1 | 1 | ... | ...... | ...... |
| 26. Tacsonia pinnatistipula by pollen of Tacsonia mollissima | 6 | 3 | 2 | 1 | 190 | 52 |
| 27. Tacsonia mollissima by pollen of Tacsonia pinnatistipula | 6 | 3 | 1 | 2 | 116 | 0 |
| 28. Passiflora racemosa by own pollen | 20 | 1 | 1 | ... | ...... | ...... |
| 29. Passiflora cærulea No. 1 by own pollen | 12 | ... | ... | ... | ...... | ...... |
| 30. Passiflora cærulea No. 2 by own pollen | 8 | ... | ... | ... | ...... | ...... |
| 31. Passiflora alata No. 1 by own pollen | 20 | ... | ... | ... | ...... | ...... |
| 32. Passiflora alata No. 2 by own pollen | 12 | ... | ... | ... | ...... | ...... |
| 33. Passiflora alata No. 3 by own pollen | 12 | ... | ... | ... | ...... | ...... |
| 34. Passiflora holosericea by own pollen | 24 | ... | ... | ... | ...... | ...... |
| 35. Passiflora manora by own pollen | 18 | ... | ... | ... | ...... | ...... |
| 36. Tacsonia pinnatistipula by own pollen | 10 | ... | ... | ... | ...... | ...... |
| 37. Tacsonia mollissima by own pollen | 3 | 3 | ... | 3 | 740 | 721 |

impotent on the stigmas of the *T. mollissima*, for not even one of the ovaries thus treated swelled.

For facility of reference, I will here subjoin, in a tabulated form, though in a somewhat different order, the more interesting results of the foregoing experiments.

*Conclusion.*—In the annexed Table we have the results of 37 distinct unions, in which 294 flowers were experimented upon, and the following curious phenomena are exhibited in the functional correlations of the sexual elements.

*First*, from ten unions of *Passiflora racemosa*—six unions as female and four as male—with other species, six fertile conjunctions were the result. Of these, one instance alone occurs in which the two species reciprocally fertilized each other, viz. in the case of *P. racemosa* and *P. cærulea* No. 1. With the two other plants of *P. cærulea* Nos. 1 & 2, *P. racemosa* treated as female yielded nothing, whereas by a converse experiment, *P. cærulea* No. 2 by pollen of *P. racemosa*, successful conjunctions were effected (*vide* Table, line 5). Again, *P. racemosa* may be readily fertilized by pollen of two individuals of the *P. alata* Nos. 1 & 3 (*vide* Table, lines 8 & 10), yet I failed in effecting a converse union by applying pollen of the *P. racemosa* to the *P. alata* No. 1. Similar results were derived from experiments on the *P. racemosa* and the *Tacsonia mollissima*, pollen of the latter proving potent on the stigmas of the former, whereas in the converse case the pollen of the *P. racemosa* is utterly ineffective on the stigmas of the *T. mollissima*. Though the *P. racemosa* will thus simply or reciprocally unite with the above species, it will be seen, by looking at line 28 of Table, that it is, nevertheless, perfectly sterile when treated with its own pollen. It is further worthy of remark that, with the exception of *T. mollissima*, the other five plants experimented upon likewise proved insusceptible of fertilization by their own pollen.

*Secondly*, in lines 11 to 14 inclusive of the Table we have the results of four unions in each case between three plants of the *P. cærulea*. These show that the pollen of an individual, A 1, for example, will readily fertilize the female element of another individual, A 2, whereas A 2 will not fertilize A 1; yet the female elements of both A 1 & 2 are susceptible of fertilization by the pollen of a third individual, A 3. Again, by consulting lines 29 & 30 of the Table, we see that the plants here given as A 1 & 2 cannot be fertilized by their own pollen, and I am told that plant A 3 is likewise insusceptible to fertilization by its own pollen.

*Thirdly*, we have the complicated results of the pure and mixed unions of the three individual plants of the *P. alata* one with another, and with distinct species. Of the four pure unions given in lines 15 to 18 inclusive of the Table, one alone is fertile; thus the female element of A 1 can be fertilized by the male element of A 2, but the male element of the former fails to effect fertilization on the female element of the latter. Nearly similar results are afforded in the reciprocal experiments with A 1 and A 3, in which we have no fertile unions, though we have clearly symptoms of a conjunctive susceptibility in the setting of three of the ovaries (*vide* Table, lines 17 & 18). Again, the male elements of two of these plants of *P. alata*, A 1 & 2 respectively, fertilize the female element of the *P. racemosa*; and the male element of A 1 will fertilize two distinct species of the nearly allied genus *Disemma* (*vide* Table, lines 20 & 22). Though we have here proofs of the potency of the male element of these three plants of the *P. alata* and of the goodness of the female element of one of them, they nevertheless all proved utterly impregnable by their own pollen (*vide* Table, lines 31, 32 & 33).

*Fourthly*, we have the curious results of the unions between *P. holosericea* and *P. manora* (*vide* Table, lines 24 & 25), in which the male element of the latter effects the perfect development of the ovaries of the former, while it utterly fails in effecting the slightest development of the seeds. Again, in the converse experiment the male element of the *P. holosericea* is almost impotent on the female element of the *P. manora*, as only in one instance did a single ovary set, and this did not continue swelling. When these two species are fertilized with their own pollen we find utter impotence, as shown in lines 34 & 35 of the Table, for in a large number of flowers thus fertilized in no single instance did an ovary set.

*Lastly*, the male element of the *Tacsonia mollissima* effectively fertilizes the female element of the *T. pinnatistipula*, while in the converse experiment, though the pollen of the *T. pinnatistipula* applied to the stigmas of *T. mollissima* effects the perfect development of the ovarian coats and the hard or spermodermic coverings of the seed, it utterly fails in effecting the development of the embryo and albuminous matter. Again, *T. pinnatistipula*, though in general very insusceptible to own pollinic influence, does in rare cases, as shown in previous details, yield a fine plump ovary filled with apparently good seeds. On examination, however, I have invariably found that the spermoderm and albumen had alone been developed, while the embryo was entirely absent.

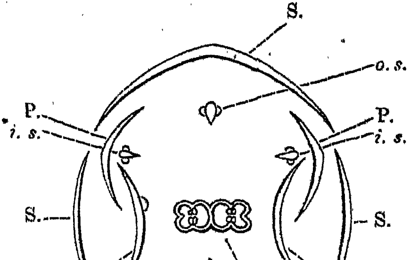
# On a Peloria and Semidouble Flower of *Ophrys aranifera*, Huds.

By Maxwell T. Masters, M.D., F.L.S.

[Read June 16, 1864.]

The flower, an account of which I now beg leave to lay before the Society, has a special interest, inasmuch as it presents (so far as I have been able to ascertain) a larger number of distinct parts, and a nearer approach to the typical form of Orchis flower than any yet discovered. It formed one of a series recently gathered in the vicinity of Folkestone, and all of which differed more or less from the ordinary condition. The present one is selected for comment as being the most perfect and complete of the whole, and combines in itself most of the peculiarities of structure met with in the other flowers, together with others special to itself. The flower in question was one of a cluster of three, which exhibited an increase in the number of the stamens, &c.; this, the lowermost of the group, had, as may be seen from the diagram accompanying this note, three sepals, five petals, four columns, and a two-celled inferior ovary, with four parietal placentas. On closer inspection it was found that the three sepals were not at all different from those of the normal flower. The three petals next in succession were also, in form and position, in their ordinary state. In colour, however, the two upper lateral petals differed from what is customary, in having the same purplish-brown tint which characterizes the lip. Within these petals, at the upper part of the flower, there was the ordinary column, and at the

*Ophrys aranifera.*



S.S.S. Sepals. P.P. Petals. L. Labellum.
o. s. Outer stamens, the two lateral ones petaloid, one bearing half an anther.
i. s. Inner stamens. O. Ovary.

opposite side, alternating with the petals before mentioned, two additional lip-like petals, one provided with a half-anther containing a single perfectly formed pollen-mass. It is, perhaps, worthy of notice that the arrangement of the coloured spots on the true labellum, and that on the adventitious lips, replacing the two lower of the outer stamens, were not of a similar character. The supernumerary lips had the $\pi$-shaped marking which is so very common in this species, while the true lip was, as to its spots, much more like *O. apifera.* Alternating with this last whorl were three "columns," all apparently perfectly formed and differing only from the ordinary one in their smaller size. The ovary had the characters already mentioned. Viewing this flower with reference to the theoretical structure of Orchid flowers, as explained by Robert Brown*, and more recently by Mr. Darwin†, its peculiarities (save those of the ovary) seem susceptible of ready explanation. The first and second whorls are but little affected; the third whorl, which, under ordinary circumstances, is represented by a single column, is here present in the form of one perfect column and two petaloid ones; of the latter, one, indeed, is provided with half an anther (as in *Canna*). These petaloid columns are usually not developed as distinct organs, but are inseparably fused with the labellum. I may here add, that I found numerous instances in which one or both of the lateral petals were adherent to the column, thus illustrating that tendency to adhesion between these organs which is (supposing Mr. Darwin's views to be correct) so remarkably carried out in the case of the lip. The fourth whorl of three columns corresponds precisely to the inner staminal whorl, which is usually entirely wanting. In the *Ophreæ*, indeed, Mr. Darwin‡ declares that the spiral vessels, by which the presence of this inner row of stamens in other Orchids may be detected, are not to be found. The two-celled pistil is not so easily explained. At first sight it appeared as if there had been a fusion of two pistils and an obliteration of two placentas; but if this view be taken, it will be very difficult to account for the number and position of the other whorls of the flower, which are so readily referable to the typical form.

For the sake of comparison, I subjoin a brief notice of some of the deviations from the ordinary structure of the andrœcium in Orchids, as recorded by various observers.

In *Dendrobium normale*, Falconer, not only is the perianth regular, but the column is triandrous[*], the three stamens (according to the diagram of its structure given by Lindley[†]) pertaining to the outer row. Richard, as cited by Moquin-Tandon, Lindley, and others, describes and figures a peloria of *Orchis latifolia* with regular triandrous flowers[‡].

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* Linn. Trans. xvi. p. 685.

† Fertilization of Orchids, p. 286.

‡ *Op. cit.* p. 296, *adnot.*

In a flower of *Habenaria chlorantha*, described by the late Prof. Henslow[§], the outer three stamens are suppressed, while two of the inner group are present, as happens normally in *Cypripedium*.

Wydler describes a flower of *Ophrys aranifera* in which one outer and two inner stamens were present[‖]. I have myself met with three such flowers among the series referred to in the beginning of this note.

Alphonse DeCandolle[¶] figures a flower of *Maxillaria* in exactly the same condition, so far as the stamens are concerned, as those just mentioned. It is curious to observe that in many of these cases the two lateral petals are suppressed.

Dr. J. E. Gray exhibited at the Botanical Society of London, in August 1843, a specimen of *Ophrys apifera* with a triandrous column, the supernumerary anthers belonging, apparently, to the inner whorl.

In his Catalogue of the Plants of South Kent, the Rev. G. E. Smith[**] describes and figures a flower of *O. aranifera* with a triandrous column, seemingly of the same kind as that spoken of by Dr. Gray.

I have examined in the Royal Gardens at Kew a flower of *Cattleya crispa* in which were three stamens, the central one normal; the two lateral ones, belonging probably to the inner whorl, were in appearance like the lateral petals, and one of them was adherent to the central perfect column. A flower of *Cattleya violacea* also afforded me a similar instance; but in this case only one of the inner stamens was developed, and this in the form of a small petal, partly adherent to the column.

Dr. Seubert[††] figures a flower of *Orchis palustris* in which there were four placentas alternating with the outer divisions of the perianth; but in this case the pistil was one-celled, and the whole flower tetramerous, with the exception of the stamens, only one of which was perfect as in the ordinary flower.

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[*] Lindl. Orchidol. of India, Journ. Linn. Soc. iii. p. 9.

[†] Lindl. Veg. K. ed. 3. p. 183, *a*.

[‡] Mém. Soc. d'Hist. Nat. ii. 1. p. 212, pl. 3.

[§] Journ. Linn. Soc. ii. p. 104.

[‖] Archiv der Botan. ii. p. 300, tab. 16. fig. 11.

[¶] Monstr. Végét., in Neue Denkschrift. p. 17, pl. 7.

[**] P. 56, tab. 4. fig. 16.

[††] Linnæa, xvi.

The only figure of a double Orchis, that I am acquainted with, is that given by Jacob in his Catalogue of the Plants of Faversham, published in 1777, which figure represents, apparently, a perfectly regular double flower of *Orchis Morio*; but how the doubling is produced there is no evidence to show. It will be remarked that none of these instances, except, possibly, Dr. Jacob's flower, presented so large a number of organs and so close an approximation to the theoretical construction of the flower, as the one which I now bring under the notice of the Society as the most perfect form of irregular peloria yet observed among Orchids.

Since the above remarks were laid before the Society, I have been made acquainted with two other instances of malformed Orchis flowers which are too interesting to be passed over. The first (for a knowledge of which I am indebted to the kindness of Professor Asa Gray and Mr. Darwin) occurred in some specimens of *Pogonia ophioglossoides* collected by Dr. J. H. Paine in a bog near Utica, New York. It will be seen from the following description that these flowers presented an almost precisely similar condition to those of the *Ophrys aranifera* before mentioned. "The peculiarities of these flowers," writes Professor Gray, "are that they have three labella, and that the column is resolved into small petaloid organs. The blossom is normal as to the proper perianth, except that the labellum is unusually papillose, bearded almost to the base. The points of interest are, first, that the two accessory labella are just in the position of the two suppressed stamens of the outer series, viz. of $A^2$ and $A^3$, as represented in the diagram*; and there is a small petaloid body on the other side of the flower, answering to the other stamen, $A^1$. Secondly, in one of the blossoms, and less distinctly in another, two lateral stamens of the inner series, $a^1$ and $a^2$, are represented each by a slender naked filament. There are remaining petaloid bodies enough to answer for the third stamen of the inner series and for the stigmas, but their order is not well to be made out in the dried specimens."

The other instance to which I have alluded is one published by Dr. Moore of Glasnevin in Seemann's Journal of Botany (1864). In this case the flowers of *Orchis pyramidalis* are described as double, the sepals and petals being multiplied, and the stamens and pistils partly petaloid. Furthermore, in some of the flowers which Dr. Moore was kind enough to forward me for examination I found not only an increase in the number of petals, especially of the labella, but also central floral prolification—a small raceme, that is, standing up in the centre of the flower in the situation usually occupied by the column, here entirely wanting. What is very remarkable also is, that each of the accessory flower-buds is again the subject of prolification. This is, I believe, the first recorded instance of median floral prolification in this natural order, and as such should be added to the list given in my paper on that subject*.

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* Darwin, Fertiliz. of Orchids, p. 292.

## Observations on the Morphology and Anatomy of the Genus *Restio*, Linn., together with an Enumeration of the South African Species. By Maxwell T. Masters, M.D., F.L.S.

[Read April 16, 1863.]

[Plates XIV. & XV.]

For the opportunity of studying the genus *Restio*, or more properly speaking, the South African species of that group, I am especially indebted to the kindness of Drs. Hooker and Sonder, and of Professors Harvey and Daubeny. These gentlemen have with great liberality placed their collections at my disposal for study and examination, and I can only regret that my imperfect leisure and the pressure of other avocations should have prevented me from repaying their kindness by laying before the Society a more perfect account of these plants than is to be found in the following observations. Crude and ill-digested as they may be, I would yet hope that they may be of some little service to botanists, as, from the abundant material at my disposal, I trust I have been able to rectify some errors into which my predecessors in this field have fallen from want of sufficient evidence. Dr. Sonder's collections have been of especial service to me, not only from being more complete and copious than any other, but also because they contain many of Nees von Esenbeck's typical species, labelled by the author himself, and frequently also accompanied by manuscript notes.

The origin of the genus *Restio* is somewhat curious. It was first published by Linnæus†, not before it had been recognized as

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* Trans. Linn. Soc. vol. xxiii. p. 369.

† Syst. Nat. ed. 12. tom. ii. p. 735, Addenda, anno 1766.

distinct by Rottboell, who assigned to it the manuscript name *Kyllinga*[*], a name which he subsequently transferred to a genus of Cyperaceæ on finding that he had been forestalled by Linnæus. Linnæus took as the type of his genus a species which he called *R. dichotomus*, the only one, apparently, known to him when he established the genus, and which he considered at that time as identical with *Schœnus Capensis*. Rottboell, in the works cited below, added several new species, which were adopted and others added in the following or 13th edition of the 'Systema' (1791). Great confusion exists in books, and still greater in herbaria, as to Linnæus' *R. dichotomus*, the species upon which the genus was established. Rottboell considered it as identical with his own plant, figured in his Descr. et Ic. tab. 1. fig. 1, and which is now known as *Thamnochortus dichotomus*, Br.[†] Linnæus' description is so vague, that by its aid alone the plant intended could hardly be recognized; it runs thus, "Gramen sæpe sterile, quasi viviparum, e foliis minutissimis aliquot pilis interstinctis." Linnæus' own copy of the 12th edition of the 'Systema,' now preserved with his herbarium in the library of our Society, contains numerous manuscript notes in the author's own handwriting, and, fortunately for our present purpose, there is an annotation referring to *R. dichotomus*, and which I here transcribe, in the hope that it will definitely settle the synonymy of this much-disputed species: "*Thamnochortus fruticosus*, Berg. Fl. Cap. 353. t. 5. f. 8 (1767). Differt a *Schœno Capensi*, quæ alia planta . . . . ." Hence the original *R. dichotomus* is no *Restio* at all, but a *Thamnochortus*, whose further synonymy I hope to unravel in a future communication. The species subsequently added by Rottboell, Linnæus, and others are partly retained, partly distributed through the genera *Calopsis*, *Elegia*, *Thamnochortus*, *Staberoha*, *Hypodiscus*, &c., and which I hope to make the subjects of future communications to the Society. For the purposes of this paper I adopt the genus as defined by Kunth[‡], which thus includes those diœcious Restiaceæ with persistent sheaths, flowers in spikelets, each provided with a two-rowed perianth of six, or rarely four, unequal segments. In the male flowers, which are generally numerous, the anthers are one-celled; in the female spikelets the florets are rarely solitary, and if so, not strictly terminal. The fruit is a one-, two-, or, very rarely, three-celled dehiscent capsule. Among diœcious plants, of which it commonly happens that botanists are cognizant of one sex alone, and among which the sexes are very liable to be wrongly matched, the limitation of the genera must of necessity be very uncertain. This uncertainty and confusion pervades the writings of authors on this and allied genera, and I cannot but think that observers should refrain from publishing new groups in this family until they are in a position to examine and describe both sexes.

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[*] Rottb. Program. 1772; ejusdem Descr. et Ic. 1773, p. 1.

[†] Brown, Prod. 244 in adnot. of Kunth, Enum. iii. p. 433. n. 7.

[‡] Enum. Plant. iii. p. 382.

As I proceed, I shall, I believe, be enabled to show that, as Nees surmised, *R. aristatus*, Thunb., and some few allied species differ greatly as to their female flowers from true Restios, although the male flowers are indistinguishable from those of the latter genus. In this particular instance the male plants are common in herbaria, and are comparatively well known to botanists; but the female plants are so rare, that hitherto I have only met with them in Dr. Sonder's herbarium, wherein they are named by Nees himself. The last-mentioned botanist has incurred some blame for assigning so well-known a plant as *R. aristatus* to a new genus, but this I believe to be due to the cause already mentioned, viz., the rarity of female plants in collections. On the other hand, Steudel's genus *Ischyrolepis* must, from the evidence I shall adduce, be suppressed, and merged in the genus *Restio* (see *R. subverticillatus*).

But the consideration of this portion of my subject I propose to defer until after I have given an account of the organography and minute anatomy of the genus *Restio*—an account which, however imperfect, will apply in many points *mutatis mutandis* to the other genera of the order.

In outward appearance and habit these plants have much of the aspect of their near allies the Sedges and the Rushes. Their roots present little worthy of comment, being merely simple fibres of woody texture and more or less flexuose habit, descending from the under surface of the stock. In *R. triflorus*, Rottb., and some other species the fibres spread horizontally for some distance, and do not at once descend. The direction may possibly be connected with the nature or depth of the soil in which the plants grow.

*Rhizome or Rootstock.*—This is usually contracted and small, giving origin to the roots below, and throwing up the culms from its upper surface; occasionally it is extended horizontally, and is then spoken of as "creeping," though this habit seems not common in this particular genus of Restiaceæ. In what I believe to be a new species, *R. Harveii*, mihi, this creeping rhizome is more clearly marked than in most other species.

*Culm.*—All writers who have described species of this order speak of the branches thrown up from the rootstock as "culms," and although Bischoff and other terminologists restrict the use of the word "culm" to the order Gramineæ, and apply the term "calamus" to such stem-structures as we have in *Restio*, I have deemed it advisable to retain the word "culm" for this family, as sanctioned by the invariable practice of Linnæus, Thunberg, Robert Brown, and I believe of all systematic writers. In the face of such overwhelming authority it would be pedantic, to say the least, to employ another term, and it would moreover lead to confusion.

The culms then ascend more or less vertically upwards from the rhizome,—if of large diameter, then in comparatively small numbers; if small and filiform, then generally they are numerous and tufted. In either case they are simple or more or less branched, the branches bearing the inflorescence at their extremity or being merely sterile. The sterile branches are often distinct in habit and appearance, as in function, from the fertile ones. In form, the culm and its branches, whether fertile or barren, are generally cylindrical, but may be more or less compressed or angular. Where the branches are numerous and crowded, the compressed form is evidently due to that accommodation process of which the order presents so many marked illustrations. *R. tetragonus*, Thunb., is the only species, so far as I am aware, whose culm is markedly tetragonal; in this case the branches are slightly compressed, and their sides fit into the grooves of the parent culm. The surface of the culm and its subdivisions is either smooth, tuberculated, or studded with minute depressions. The colour varies even in the same specimen, and greatly depends on the age of the plant; that of the dried specimen differs considerably, so far as I have had the opportunity of observing, from that of the living plant.

The disposition of the branches affords occasionally a useful means of discriminating the species. The culm ordinarily divides di- or trichotomously, but occasionally the subdivisions are more numerous, and then we have the branches coming off in fascicles or tufts, while at other times, as in *R. subverticillatus*, the branchlets are verticillate. The main culm divides near to its base, or towards the centre, or quite at the upper portion, thus giving a distinctive aspect to the plant, although the characters so afforded have no great value in the discrimination of species. The same remark applies, though to a less extent, to the direction of the branches, whether erect or more or less spreading, &c.

*Foliage.*—The leaves in these plants are for the most part reduced merely to the sheath, with a mere rudiment of a stalk or blade, but as they vary in form with the different parts of the culm, it is necessary to speak of them according to their position. The base of the culms is always invested by a number of closely imbricated leaf-sheaths (cataphyllary leaves*). These are usually of a dark colour and an elliptic form, with a mucro or awn projecting from their dorsal surface, just below the apex, almost exactly as in *Juncus*. These scales always closely invest the base of the culm, and increase in size from below upwards, passing more or less gradually in form and colour to those on the middle and upper portion of the culm. The culm-leaves, or "vaginæ" as they are technically called, are separated one from the other by considerable intervals; below they merge into the stock-leaves, while above, with more or less abruptness, they merge into the bracts or scales of the inflorescence. These sheaths encircle the stem, sometimes closely, at other times more loosely: this difference, though apparently of little physiological importance, furnishes, from its constancy, a good character for the discrimination of species, while the disunion of the margins of the sheath throughout the whole order is a character of importance as separating its members from the Cyperaceæ. The form of the upper portion of the sheath varies considerably, very generally the margins are membranous and more or less hyaline. From the middle of the back of the sheath, just below the apex, projects an organ, which, according to its form and size, is spoken of as an awn, a mucro, or even a leaf. In *R. graminifolius*, Kunth, this so-called leaf is more highly developed than in any other species yet met with. Morphologically, this portion may be considered to be the upper part of the leaf-stalk, assuming that the true leaf-blade is absent in these plants as indeed in the majority of Monocotyledons. If this be so, have we not in the membranous apex of the sheath the homologue of the "ligula" of Grasses, and similar formations? In the culm-sheaths the true nature of the awn or mucro is not in general so well shown as in the sheaths of the smaller branches, where the awn usually assumes the appearance of a curved needle-shaped leaf. In these smaller sheaths it commonly happens that the membranous apex of the sheath becomes cleft into two divisions, in which case the resemblance to a needle-shaped leaf with two membranous adnate stipules is very marked. In some species of the allied genus *Hypolæna* the membranous edge of the sheath is regularly cut up into a number of hair-like *laciniæ*, similar to those constituting the "ligula" of *Saccharum*, &c.

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* See Henfrey's translation of Braun's 'Rejuvenescence,' Ray Society, 1853, p. 62, &c.

In many of the species, and most markedly so in *R. venustulus*, *R. laniger*, and *R. scoparius*, the sheaths enclose an inner oblong scale, which is marked on one surface with two prominent hairy ribs. This scale is placed at the bifurcation of the culm or branch, and apparently serves as a kind of cushion or pad, the culm or branch fitting into the groove between the two projecting "costæ."

*Bracts.*—The bracts or scales of the inflorescence do not differ materially from the other foliar organs just mentioned; ordinarily they are shorter and do not completely encircle the axis as the lower ones do. The lowermost or outermost bract is sometimes different from the rest, having then more of the character of the true culm-sheaths; in this case it may be compared to the spathe of Arads, or the outer glume of Grasses. In many instances the bract next above the lowermost, and which is pressed up against the axis, has the oblong form, and the two woolly ribs, such as have just been mentioned as occurring in the forks of the branches in *R. venustulus* and many other species. Pressure here evidently determines the presence of these two ribs, as probably also in the instance of the inner palea of Grasses, which occupies a precisely similar position with reference to the axis. Other illustrations of the same kind may be noticed in *Iris*, in *Philydrum*, &c., in those bracts which are pressed between the axis and the flower-bud.

The bracts are sometimes all about of the same size and form, while at others the lower ones are the smallest, and gradually increase upwards till they approach the top of the spikelet, when they again diminish in size; in the latter situation also they often lose the mucro or awn which the lower scales are for the most part provided with*.

Good specific characters are afforded by the comparative length of the bracts and of the florets they subtend, a difference which may be of physiological importance with reference to the facilities for ensuring fertilization, but upon which points no evidence yet exists.

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* The observer cannot fail to be struck with the foliaceous awn projecting from the back of the inner involucral scale of *Picris echioides* just below the apex, exactly as in the sheaths of Restiaceæ or in the paleæ of Grasses.

*Inflorescence.*—This consists in both the male and female plants of spikes or spikelets of various forms and sizes, according to the species or to the age of the individual plant. The spikelets are sometimes placed singly at the ends of the culms or branches, more frequently they are disposed in cymes, the cymes being more or less dense, sometimes spike-like, or more frequently paniculate. In some cases the inflorescence of the male and female plants is alike, while in others it differs; in this latter case the male plant generally has numerous spikelets arranged in panicled cymes, while the female spikelets are less numerous and spicate in their arrangement. Occasionally monœcious plants are met with wherein both male and female spikelets occur in the same inflorescence. Kunth mentions this in *R. intermedius*, and I have met with it in *R. ferruginosus.* The individual spikelets are erect or spreading, very rarely pendent; some are sessile (terminal), others pedicellate, the pedicel being compressed from side to side, grooved lengthwise to accommodate the spikelet, and increasing in breadth from below upwards. In *R. triticeus*, as observed by Rottboell, the back of the spikelets is parallel to the rachis—in other words, the spikelets are attached to the rachis in a transverse manner as in *Triticum.* In the great majority of the species the spikelets have their edges (not their backs) turned towards the rachis, as happens also in *Lolium* among Grasses. From the cylindrical or somewhat globose form of the spikelets in some instances, it becomes difficult to ascertain the real position of the spikelets with reference to the axis. If the spikelets be crowded, they are somewhat curved so as to get out of one another's way; but if the spikelets are placed at some distance one from another, no such curvature is necessary.

In *R. graminifolius* a peculiar circular cushion-like pad of cellular tissue is to be seen at the angles formed by the diverging pedicels. The purport of this little cushion is unknown to me; its existence has not, so far as I am aware, been previously noted, nor have I yet seen anything similar in any other species.

Each spikelet consists of a number of bracts or scales, in the axils of some or all of which are placed the flowers. In the male plants all the bracts, with the exception perhaps of the outermost or lowest and the one next above it, are fertile, while in the female spikelets it not unfrequently happens that one or two only of the upper scales have flowers in their axils. The scales are arranged in spiral series, the number of scales in each cycle being different in different species. In *R. quinquefarius*, N. ab E., the scales are arranged in five well-marked vertical ranks, separated one from another by deep grooves*.

The male flowers, as also the immature female ones, are compressed from back to front, and are straight, or so curved as to be convex on the surface nearest the bract, while their outline generally coincides with that of the protecting bract.

The peculiar form of the florets is due to pressure against the axis; it exactly resembles the form of the unexpanded buds of the garden hyacinth while they remain closely packed and pressed up against the axis. Moreover, in *Boeckhia*, *Willdenovia*, and some other genera of this order, where the female flowers are solitary and placed upon or near to the extremity of the axis, and where in consequence the flowers are not subject to compression, the florets have not the flattened form that they have in *Restio*. The same rule applies to species of *Elegia*, *Lepyrodia*, and in fact to all wherein, from whatever cause, no pressure is exerted on the flowers.

The flowers themselves vary much in size in reference to the bracts, sometimes even exceeding the latter organ. When the capsule is ripe, the florets are necessarily altered in form and become more or less spheroidal. The florets are sessile within the bracts, or placed on very short stalks, in which latter case the inflorescence is not strictly spicate, though it would in practice be an unnecessary refinement to consider the inflorescence as other than a spike.

Each flower or floret (I use the two words indifferently in this case) consists of a perianth of six, or rarely of four glumes, arranged in two rows. The outer series consists of three pieces, placed in such a manner that one is central and anterior or next to the bract, and two lateral and somewhat posterior: the anterior one is usually flat or only slightly convex; the two lateral ones are conduplicate, boat-shaped, and marked in the centre of the dorsal surface by a projecting central nerve or carina, which is very generally clothed with woolly hairs. The three inner glumes alternate in position with the outer ones, and usually resemble the anterior glume in shape, but are of thinner texture. In some species, as *R. triticeus*, the inner glumes are slightly coherent at the base, in others each glume is thickened at the lower end. In the female flowers, especially of the two-styled section, it often

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* Cfr. A. Braun, Nov. Act. Acad. Nat. Cur. xv. p. 2.

happens that the two inner lateral glumes have their margins somewhat involute and wrapping round the style, while the posterior one remains flat. In form, relative size, texture, colour, &c., these glumes vary considerably in different species, and afford good distinguishing characteristics. In all cases they are "persistent" around the ripe fruit, and sometimes "accrescent." The inner lateral glumes of *R. setiger* present a peculiarity which is worthy of notice, and which consists in the existence on the middle of their inner surface of a cushion-like pad of cellular tissue; the central posterior glume has only a very small central thickening, but both its edges are rolled inwards around the style. It would seem as if these excrescences, conjoined with the infolded margins of the glumes, must serve some special purpose in relation to the fertilization of the plant, but without an examination of fresh specimens it would be idle to speculate on this point. The growth in question will remind the observer of the glands on the outer surface of some of the segments of the perianth in *Rumex*.

In *R. bifurcus*, N. ab E. MSS., there is between the inner glumes and the stamens a small membranous lobed cup or disk, which may possibly represent a row of abortive stamens outside those which are usually present, and which it will be remarked are opposite to the inner glumes; if the disk, to which reference has just been made, be really the representative of an outer series of stamens, then the symmetry of the flower would be restored.

The male flowers have usually three hypogynous stamens placed opposite to the inner glumes, as just stated, but in *R. tenuissimus* there are but two, while in some of the Australian species there are six, thus completing the floral symmetry. The filaments are generally flattened and ribbon-like, attached by their upper ends to the back of the anthers a little above their base, so that the latter are described as peltate in spite of their erect, not horizontal, position. In the young flowers the filaments do not greatly exceed the anthers in length, and thus the whole of the stamen is included within the glumes; but after, very rarely before, the bursting of the anther, the filament lengthens, so that ultimately the anther projects beyond the glumes. I have never observed unopened anthers protruding from the perianth.

In form the anthers are linear or oblong, often surmounted by a small mucro, which originates just below the apex on the dorsal surface as in the sheaths and bracts.

The dehiscence of the anthers takes place lengthwise along a central suture, and thus exposes a single cavity. The anthers are generally yellow on the ventral surface, reddish brown or purple on the dorsal aspect.

The pollen consists of separate oblong or spheroidal cells, smooth on the outer surface, and each provided with a single furrow.

In the three-styled section a rudimentary pistil (*pistillodium*) is found in the centre of the male flower, its three lobes alternating with the stamens and each surmounted by a rudimentary style.

The perianth in the female flowers resembles that of the male in all important particulars. Those species that are provided with three styles have also three antherless filaments (*staminodia*) within the inner glumes. The ovary is generally oblong or roundish, compressed from back to front, one-, two-, or three-celled; in the latter case the three carpels alternate with the stamens, and are placed opposite to the outer segments of the perianth, so that two carpels are posterior or next to the axis, while one is anterior or next to the bract. In Grasses the theoretical position of the carpels is exactly the reverse of this, the odd carpel being in that family posterior*. In point of size, the ovary itself is usually considerably shorter than the glumes, but the styles by which it is surmounted usually project beyond the perianth.

The styles vary in number from one to three. In those cases where there is but a single style, it is generally divided halfway down into two linear recurved branches, with feathery stigmatic hairs on the inner surface. Two distinct styles are rarely met with. When there are three styles, the ovary is generally inversely conical in form, and the styles project one from each of its upper corners. In a few species the base of the style is dilated into a yellow "stylopod" surmounting the top of the ovary, e. g. *R. setiger*. It has been proposed by Kunth† to separate the three-styled species from the rest and to form them into a new genus, a proceeding in which I am not disposed to concur, as it would break up a tolerably natural easily defined group into two less sharply limited divisions.

The fruit is capsular, one-, two-, or, very rarely, three-celled, dehiscing longitudinally along the edges of the carpels. Its form varies according to the presence of all its constituent carpels, or the abortion of one or more of them. It is surmounted in all cases by the rudiments of the styles.

There is usually but a single seed, occupying the whole of the interior of one compartment of the fruit, from the upper and inner angle of which it is suspended by a very short funiculus; in form it is usually oblong, obscurely three-sided, slightly pointed at the upper end, flattened and somewhat quadrangular below. The testa is cartilaginous, greyish in colour, usually covered with minute pits, between which are interspersed purplish spots; in other cases the testa is studded with small whitish tubercles, giving the seed the aspect of being studded with minute pearls.

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* See a paper of Nees von Esenbeck's in 'Linnæa,' v. p. 680, wherein a tricarpellary Grass is figured and described.

† Enum. iii. p. 397, adnot.

The perisperm is very copious, white, horny or somewhat farinaceous.

The embryo is a small lenticular fleshy mass placed in a little socket, at that end of the seed most remote from the hilum.

*Teratology.*—All the Restiaceæ appear to be subject to the occasional presence of bud-like aggregations of scales, like the bracts, but destitute of flowers. They are frequently found replacing the true inflorescence, and may be arranged in spikes or panicles. They are by no means confined to the inflorescence or to the fertile culms, but may be met with proceeding from the axils of the sheaths of the stem, or in the angles between two diverging branches. The scales in these instances are generally closely packed, but occasionally the central axis lengthens, and then the scales become separated by greater or less intervals one from another. These growths are of similar nature to those that occur in the so-called Rose Willows and other plants. Monœcious specimens sometimes occur, as has been before stated. In one instance only have I seen a truly hermaphrodite flower of *Restio*, and this occurred in a fragment of an undetermined species. In *Lepyrodia hermaphrodita* this condition is common, and it also occurs, though very rarely, in other genera.

*Minute Anatomy.*—Sections of the root of *R. triflorus*, made in various directions, exhibit on the outer surface an epidermal layer destitute of stomata; subjacent to this are three or four rows of large, loosely-packed oblong cells, polygonal on cross section, and having slightly thickened walls; these again encircle a thick layer of pitted liber-cells, which are of a deep-brown colour. In the centre is a cylinder of wood-cells, with thick walls and few, if any, pits; intermingled with these are a small number of slit-marked ducts.

The structure of the rhizome is very similar to that of the root; there is a similar thick dark-brown epidermis covering a layer of very large dark-coloured liber-cells. The great mass of the rootstock, however, consists of oblong or polygonal, thick-walled, pitted cells, mingled with which in great abundance are pitted and barred ducts in groups of three to six, each group of vessels forming a centre around which the cells just mentioned are disposed.

*Culm.*—An examination of the structure of the stem of *R. ferruginosus*, Link, reveals an epidermis of somewhat quadrangular cells, destitute of chlorophyll, and having a few scattered stomata, protected by two oval guard-cells. In old stems the epidermal cells increase greatly in size, and become very thick-walled, especially on the outer side. Many of them contain masses of a dark-brown substance, probably of a resinous nature. Not unfrequently the outer wall of these resin-bearing cells breaks away, leaving a funnel-shaped cavity, which being open externally becomes filled with dirt. These funnel-shaped cells give a very peculiar appearance to the microscopic sections of the old culms (Pl. XIV. figs. 1, 2).

Beneath the epidermis in the young culms there is a series of small spherical cells containing chlorophyll (Pl. XIV. figs. 3, 4), but as they increase in age their size and form become greatly changed, their chlorophyll disappears, and thus at length in the old culms they form a thick spongy layer of flattened elongated cells, whose long diameter is at right angles to that of the culm (Pl. XIV. figs. 1, 2).

Succeeding this spongy layer, going from without inwards, is another zone of cellular tissue, consisting of three or four rows of oblong somewhat quadrangular cells, whose long diameter is parallel to that of the culm. These enclose a broad zone of thick-walled liber-cells; interspersed among these latter are numerous scattered fibro-vascular bundles. Next in order is a cylinder of cellular tissue, whose constituent cells are large, oblong or somewhat polygonal, and pitted, thus greatly resembling the pith-cells of an Exogenous plant. These pith-like cells contain numerous small oblong starch-grains, and some of them also enclose dark-brown resinous matter like that of the epidermal cells. Traversing this pith-like cylinder are scattered bundles of vascular tissue, consisting of wood-cells and barred ducts. Pitted ducts and spiral vessels seem to be entirely absent (Pl. XIV. figs. 1, 2).

The sheaths present from without inwards an epidermal layer of large, somewhat cubical cells, thickened on the outer wall, and perforated here and there by stomata, like those of the culm. Subjacent to this is a quantity of cellular tissue, the cells of which vary considerably in size, but are mostly oblong and six-sided.

The fibro-vascular bundles traverse the cellular tissue at intervals, in a straight direction from the base of the sheath upwards. Their constitution is exactly like that of the bundles of the stem.

The epidermis on the inner side of the sheath consists of smaller, thinner cells than on the outside; they are, moreover, compressed from back to front, and are not interrupted by stomata.

The bracts and glumes are similar in structure to the sheaths.

The hairs that invest the carina of the glumes are long, flattened, tortuous, irregularly branched or compound hairs. The stigmatic hairs are in tufts, in appearance like those just mentioned, but smaller and unbranched.

*Arrangement of Species.*—With reference to the grouping of the species, great difficulty and uncertainty must exist for the home observer, in the due matching of the sexes. In many cases one sex only is known, while in others the male and female plants are so different in appearance that they have been described as constituting different species. For these reasons I have, in the following arrangement, deviated but little from that published by Kunth, which is, I believe, on the whole the best that has been proposed. When the male and female plants of all the species are known with certainty, a more natural arrangement can doubtless be made by grouping the species according to the form and arrangement of the male and female spikelets.

I have endeavoured to group the species in a manner that may be practically useful to botanists. No one knows so well as myself the defects and shortcomings that pervade this arrangement, but after numerous trials the one adopted has seemed the best. I first of all take Kunth's first section, or true Restios, in which there are two connate styles. The male flowers of this section are readily recognizable by the absence of a rudimentary pistil or *pistillodium*. The presence or absence of staminodia in the female flowers, or of pistillodia in the male flowers, I find to afford valuable characters from the constancy of the distinguishing marks so afforded. The next subdivision is according to the presence of one, two, or of more florets in the ripe female spikelets. This group is again subdivided into those which have loose sheaths and those in which those organs closely wrap around the culm. In practice I find this to afford valuable characters, though apparently of little physiological importance. The succeeding groups are established according to the arrangement of the inflorescence in the male plants. I have experienced greater difficulty in subdividing the three-styled section, which Kunth proposed as a new genus, but which, from reasons already assigned, I prefer to keep as a section of *Restio*. On the whole, the most satisfactory subdivision of this group appears to be one founded on the form of the culms.

As to the species themselves, I have commented on them in their several places, and here need not say more than that I have, with as much care as I have been able to bestow, examined them all again and again, rectified and adjusted their synonymy, and reduced and combined some forms according to the best of my judgment, on the evidence before me. At the same time I have ventured to propose the establishment of some new species, hitherto, as I believe, undescribed, or indicated (without descriptions being given) by Nees von Esenbeck in Dr. Sonder's herbarium. Of these I have given rather lengthened diagnoses, feeling that shorter ones would be even more unsatisfactory than those I have drawn up.

## CONSPECTUS SPECIERUM.

### SECT. I. *Styli duo connati, rarissime distincti. Staminodia nulla. Pistilli rudimentum (in flor. masc.) nullum.*

### A. *Spiculæ femineæ pluriflora.*

### * *Vaginæ culmeæ laxæ.*

### † *Spiculæ masculæ approximatæ vel glomeratæ, femineæ solitariæ vel aggregatæ.*

R. SPRENGELII, *Mast. MSS.*—R. squarrosus, *Spreng. Syst. Veg.* i. p. 186. n. 48 (1826), nec *Lamarck*; *Nees ab Esenbeck, Linnæa*, v. p. 643; *Steudel, Flora*, 1829, i. 133. n. 6.—R. Lucæanus, *Kunth, En.* iii. p. 385 (1841), quoad pl. masc.—? R. vaginatus, *Thunb.* (fide *Steudel*, sed vix).—? R. cuspidatus, *Thunb. Fl. Cap.* i. p. 87.

*Hab.* Pr. B. Sp. Ex. s. sp. ♂. False Bay, *Robertson*, in herb. Mus. Brit.! In campis arenosis lapidosis sub monte Tabulari (Nov., Dec.); ad Dorsum Leonis inter frutices (Junio); *Ecklon*, n. 84 pro parte!; *Zeyher*!; *Sieber*!; *Harvey*, n. 388 *b*!; *Milne*, 223!; *Thom*!; *Bergius*! ♀. *Eck. Un. It.* 848!; *Eck. et Zeyh.* 77. 9!; *Drège*, 44!; Wynberg, *Wallich*!

Nomen mutavi ob antiquiorem *R. squarrosum* cl. Lamarck.

Plantæ femineæ adhuc indescriptæ characteres adjicio. *Culmus vaginæ*que ut in mare. *Spiculæ* 2–3 in apice ramorum approximatæ, erectæ, oblongo-lanceolatæ, pluriforæ. *Bracteæ* arcte imbricatæ, ovato-lanceolatæ, superne hyalino-membranaceæ, sub apice mucro-

nato subaristatæ (aristis patulis), flores ovato-lanceolatos, breviter pedicellatos, 2–3plo superantes. *Glumæ externæ* laterales duo, ovato-lanceolatæ, acutatæ, naviculari-conduplicatæ, carinatæ, carina ferrugineo villosa. *Gluma intermedia* antica ovato-lanceolata, planiuscula, dorso superne ferruginea, lateralibus vix brevior. *Glumæ internæ* 3, minores, tenuiores, ovatæ, acutæ; postica plana; lateralium margines superne involuti. *Staminodia* nulla. *Ovarium* oblongum, complanatum, biloculare, stylo elongato, superne in ramos stigmatosos duo exsertos curvatos diviso superatum. *Capsula* bilocularis (an semper?), rotundata, lenticulari-complanata, coriacea, spadicea, marginibus longitudinaliter dehiscens. *Semina* solitaria vel duo magna, oblongo-obtusa, trigona; testa cartilaginea, albida, impresso-punctulata, maculis parvis violaceis notata.

Nees, in 'Linnæa,' v. p. 643, says, in reference to the synonym *R. cuspidatus*, Thunb., "*R. cuspidatus* Thunb., quoad descriptionem, sane nimis incompletam, nulli cognitorum proprius quam isti accedere videtur."

R. OCHREATUS, *Kunth, En.* iii. p. 385. n. 3; *Steud. Synops.* ii. p. 250. n. 10.—Calopsis peronata, *Kunth, l. c.* p. 426, quoad plant. masc.—R. Lehmanni, *Nees, MSS. in herb. Sonder*, pl. masc.

*Hab.* Pr. B. Sp. Ex. s. sp. ♀. *Drège*, 47 pro parte!, 2505!; *Harvey*, 388 *c*! ♂. *Drège*, 1623!, 42!; Onderbokkefeld, *Eck. et Zeyh.* 1207!

Plantæ masculæ *culmus vaginæ*que ut in feminea. *Spiculæ* 00 in paniculam densam, ramosam, terminalem, 2–3-pollicarem dispositæ. *Pedunculi* breves, singuli spatha vaginæformi suffulti; pedicelli brevissimi, nudi. *Spiculæ* singulæ erectæ vel patentes, nonnunquam curvatæ, ovato-acutæ, 3–4 lin. long., 1–1½ lin. lat. *Bracteæ* omnes fertiles, undique arcte imbricatæ, oblongæ, recurvato-acuminatæ, coriaceæ, ferrugineæ, superne pallidiores, vix membranaceæ, flores oblongo-lanceolatos parum superantes. *Perianthium* biseriale, sexglume, *glumis externis* duo lateralibus oblongo-acutis, naviculari-conduplicatis, ad carinas ferrugineo villosis, rigidiusculis; *gluma intermedia* antica, subæquali, oblonga, arcuata, dorso medio maculis ferrugineis notata; *glumis internis* 3, brevioribus, inter se æqualibus, oblongis, subhyalinis. *Filamenta* ligulæformia, albida. *Antheræ* ovatæ, acutatæ, antice flavidæ, postice ferrugineæ, dorso peltatim affixæ, demum exsertæ. *Pistilli* rudimentum nullum.

R. FRATERNUS, *Kunth, l. c.* 386. n. 6.

*Hab.* C. B. S. Ex. s. sp. *Drège*, 45!, 1623 pro parte!

Planta feminea adhuc incognita, nisi forte sub diverso nomine descripta.

R. PAUCIFLORUS, *Poir. Enc.* vi. 168; *Kunth, En.* iii. p. 412. n. 49; *Steudel, Synops.* ii. p. 254.

Planta feminea adhuc incognita.

R. GLOMERATUS, *Thunb. Fl. Cap.* 88.
An hujus sectionis?

R. CUSPIDATUS, *Thunb. Fl. Cap.* 87.
An hujus sectionis?

R. SIMPLEX, *Thunb. Diss.* n. 15.
An huc recte referenda?

†† *Spiculæ masculæ in paniculas elongatas dispositæ.*

R. FERRUGINOSUS, *Link, in herb. reg. Berol. fide Kunth, En.* iii. p. 393. n. 20, absque pl. femin.—R. ameles, *Steud. Synops.* ii. p. 252. n. 30.
*Hab.* Pr. B. Sp. Ex. s. sp. ♂. *Ecklon*!; *Drège*, 1619 *b*!, 1620 pro parte!; Table Mountain (Julio); *Krauss*; (*Cayley*!) *Harvey*!
V. v. cult. in hort. bot. Oxon. sub nomine *Willdenoviæ teretis.*

Drège's specimens distributed under n. 1620, considered by Steudel as the type of a new species, do not differ from *R. ferruginosus*, except in the more elongated form of the branchlets and the thinner texture of the bracts, glumes, &c.

R. ELATUS, sp. n. Culmo (3–4-pedali) basi decumbente, tereti (crassitie pennæ anserinæ), versus medium parum dichotome ramoso, ramisque elongatis, erectis, compressiusculis, nitidis, viridescentibus, minutissime impresso-puncticulatis, aphyllis; vaginis subpollicaribus, laxe patentibus, ovatis, coriaceis, sub apice obtusiusculo hyalino membranaceo acuminatis: spiculis masculis 6–8, in apice ramulorum parum approximatis et in paniculam simplicem distichan dispositis, singulis cylindraceo-lanceolatis, arcuatis, erectis v. patentibus, breviter pedicellatis (6–7 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongo-acutis, coriaceis, sub apice obtuso membranaceo subulato-mucronatis, flores oblongos vix superantibus; glumis externis lateralibus duo, oblongis, obtusis, naviculari-conduplicatis, ad carinas ferrugineo villosis; gluma antica intermedia subæquilonga, oblonga, membranacea, dorso medio ferrugineo villosa; glumis internis tribus, quam externæ dimidio brevioribus, illisque latioribus, membranaceis; antheris exsertis, ovatis, apiculatis, ferrugineis: spiculis femineis 4–6, in apice culmi, erectis, approximatis, sessilibus v. breviter pedicellatis, singulis ovato-oblongis (3–5 lin. long., 1–2 lin. lat., pluriflor.); bracteis ut in mare, infimis vacuis, ceteris fertilibus, flores oblongos parum superantibus; glumis externis late ovatis, acutis, lateralibus duo conduplicatis, villoso carinatis, antice approximatis et glumam intermediam celantibus; glumis internis 3, dimidio brevioribus, membranaceis, dorso medio ferrugineis, lateralium marginibus superne parum involutis; staminodiis nullis; ovario oblongo, compresso, biloculari, stylo crasso tereti (superne in ramos duo stigmatosos curvatos exsertos diviso) superato; capsula ——.
*Hab.* C. B. S. Ex. s. sp. *Drège*, 93!, ♂ et ♀.

R. SUBVERTICILLATUS, *Mast. MS.* Culmo erecto, tereti (2–3-pedali), ad vaginas subverticillatim ramoso, ramisque filiformibus, erecto-patentibus, crassiusculis, iterum fasciculatim vel dichotome ramulosis, foliaceis vel aphyllis; vaginis culmeis laxis, ovatis, acutis, coriaceis, semipollicaribus et ultra, rameis ellipticis, superne membranaceis, sub apice bilobato hyalino subulato-mucronatis, mucrone in folium lineare arcuatum nonnunquam producto: spiculis masculis 6–8, in apice ramulorum, in paniculam simplicem disticham parum approximatis, singulis erectis vel patentibus, cylindraceo-lanceolatis, rectis v. leviter arcuatis (4–5 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, ovatis, acutis, dorso convexis, ferrugineis, coriaceis, sub apice membranaceo mucronulatis, flores paulo superantibus; glumis externis lateralibus duabus oblongis, obtusiusculis, naviculari-conduplicatis, ad carinas ferrugineo villosis; gluma intermedia antica planiuscula, oblonga, ferruginea, dorso medio parum ferrugineo villosa; glumis internis 3, brevioribus, oblongis, marginibus superne parum involutis: spiculis femineis 1–3, in apice ramulorum sessilibus pedunculatisve, erectis, ellipticis, demum subclavatis, pyriformibus (1–3 lin. long., 1–2 lin. lat.), plurifloribus; bracteis inferioribus vacuis, ceteris fertilibus, flores ovato-oblongos vix superantibus; glumis 2 externis lateralibus late ovatis, acutis, rigidis, coriaceis, ferrugineis, ad carinas dense ferrugineo villosis, glumam intermediam conformem planiusculam celantibus; glumis internis 3, minoribus, tenuioribus, lateralium marginibus superne involutis, postica planiuscula; ovario rotundato, compresso, biloculari, stylo elongato superne bifido superato; capsula oblique ovata, uniloculari, monosperma.

Ischyrolepis subverticillata, *Steudel, l. c.* p. 249, quoad plantam femineam.—R. ferruginosus, *Link fide Kunth,* quoad pl. fem.—R. casuarinæformis, *N. ab E. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. ♂. 1620 pro parte, *Drège*!; Stellenbosch, *Harvey*!; *Ecklon*!; *Zeyher*! ♀. *Drège*, 1!; *Harvey*!; *Eck. et Zeyh.* 61. 5!

V. v. cult. in hort. Angl. sub nom. *Willdenoviæ teretis.*

Steudel separated the female plant (the male was unknown to him) from Link's *R. ferruginosus*, and made it the type of a new genus, differing mainly from *Restio* in the possession of four instead of six glumes to the perianth, in the thicker glumes, and in the whorled condition of the branches. In all the specimens that have come under my observation there are six glumes, the two outer lateral ones so much larger, however, than ordinary, that they touch by their anterior margins, and hence almost wholly conceal the intermediate glume. In the male plant the form of the glumes is more obtuse and their texture less rigid than in the female plant; so that in these particulars the male plant bears very great resemblance to *R. ferruginosus*, from which, however,

it may be distinguished by the verticillate ascending, not spreading branches. Both the species just named vary a great deal in their degree of luxuriance and in the absence or presence of leaves.

*** Vaginæ culmeæ arctæ.*

R.? SQUARROSUS, *Lam. Ill.* t. 804. f. 1.—R. echinatus, *Kunth, En.* iii. 384.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 49! ♀ hucusque incognita.

Lamarck's figure evidently belongs to the plant subsequently referred to *R. echinatus* by Kunth, which must now be abandoned. Lamarck's name has precedence over that of Sprengel (see *R. Sprengelii*, Mast.). The female plant is not yet known; it may probably, when discovered, turn out to be a species of *Hypodiscus* rather than of *Restio*.

R. SETIGER, *Mast. MS.*—R. setiger, *Kunth, En.* iii. 385, quoad pl. femin.—R. fuirenoides, *Kunth, l. c.* 386, pl. masc.

*Hab.* C. B. S. Ex. sp. s. ♀. *Drège*, 2503!, ♂ 2504!

The two forms here associated appear at first sight sufficiently distinct; but a more careful examination will show that the only points of difference between the two consist in this, that the male spikelets are smaller than the female, and are moreover very numerous and densely crowded together, while in the female plant the spikelet is comparatively large and solitary or geminate. In all other essential points the two plants agree, and hence I have ventured to combine them into a single species.

R. DIGITATUS, *Thunb. Prod.* p. 15; *Diss.* p. 18. n. 21; *Fl. Cap.* i. p. 88. n. 25; *Spreng. Syst.* i. p. 186. n. 34; *N. ab E. Linnæa*, v. p. 638; *Kunth, En.* iii. p. 410. n. 46.

Var. β. Glumis latioribus, culmo crassiore, *N. ab E. l. c.*—R. obtusissimus, *Steud. Synopsis*, ii. p. 252. n. 36.

*Hab.* C. B. S. Ex. sp. s. ♂. Musenberg, *Ecklon*, n. 41!—Var. β. Hottentotshollandberg (April), *Eck.* n. 18!; *Drège*, 22!

The variety β, considered by Steudel to form a distinct species, differs from Thunberg's plant in having broadly oblong obtuse glumes. Probably this is the normal condition of the species, the linear filiform state being simply the result of arrested growth.

R. CONCOLOR, *Steudel, Synopsis*, ii. p. 251. n. 22.

*Hab.* C. B. S. *Drège*, n. 31.

" *R. scopario* affinis sed certe diversus," *Steud.*

R. SCHŒNOIDES, *Kunth, En.* iii. p. 391. n. 16, quoad pl. fem.

*Hab.* C. B. S. Ex. sp. s. ♂. *Eck.* 84 ex parte!; ♀. *Drège*, n. 50!

Plantæ masculæ adhuc indescriptæ notas adjicio. *Culmus* ut in feminea. *Spiculæ* 3–4 in apice culmi parum remotæ, singulæ ovato-acutæ, spatha vaginæformi spiculas vix æquante suffultæ; plurifloræ. *Bracteæ* arcte imbricatæ, ovatæ, subulato-acuminatæ, dorso superne impresso-punctulatæ, marginibus superne membranaceis, flores arcuatos acutos superantes. *Glumæ externæ* 3, acutatæ, subæquales, vix coriaceæ, laterales conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3, parum breviores, conformes, subhyalinæ. *Stamina* 3, filamentis complanatis, albidis. *Antheræ* ——. *Pistilli* rudimentum nullum.

In this species the style is deeply bipartite, an unusual circumstance in the genus.

R.? OBLONGUS, sp. n. Culmo pedali, basi decumbente, compressiusculo, spongioso (crassitie pennæ gallinaceæ), cinnamomeo, albo tuberculato, versus basin subfasciculatim dichotomeque ramoso, ramisque erecto-patentibus, flexuosis, elongatis, compressis, aphyllis; vaginis nisi ad ramificationes arctis, unguicularibus, ellipticis, coriaceis, tuberculatis, apice mucronato-aristatis: spiculis masculis in apice ramulorum 2–3, approximatis, sessilibus pedicellatisve, singulis oblongis, spatha aperta lanceolata longe acuminata coriacea ad margines superne membranacea suffultis (3–4 lin. long., 1–2 lin. lat.); bracteis undique laxe imbricatis, lanceolatis, ferrugineis, maculatis, flores oblongos arcuatos superantibus; glumis externis oblongis, arcuatis, pergamentaceis, ferrugineis, lateralibus 2, conduplicatis, carinatis, carina (villo delapso?) glabra; glumis internis 3, conformibus, externis vix minoribus, tenuioribus, lateralium marginibus superne parum involutis; staminibus 3, antheris oblongo-ovatis.—An hujus sectionis?
*Hab.* C. B. S. Ex. sp. s. *Drège*, 65!
Feminea adhuc ignota.

R.? CRINALIS, sp. n. Culmo decumbente, filiformi, tereti, pedali, prope basin dichotome ramoso, ramisque erectis, ascendentibus, cinnamomeis, crasse tuberculatis; vaginis arctis, ellipticis, fuscis, coriaceis, tuberculatis, sub apice subulato-mucronatis, mucrone nonnunquam in setam longissimam producto: spiculis masculis in apice ramulorum approximatis, sessilibus v. pedicellatis, singulis oblongo-ovatis (3–4 lin. long., 1–2 lin. lat.), spatha aperta lanceolata apice longe setacea suffultis; bracteis laxe imbricatis, lanceolatis, submembranaceis, medio ferrugineis, infimis 2–3 vacuis, ceteris flores brevissime pedicellatos oblongo-lanceolatos paulo superantibus; glumis externis lateralibus lanceolatis, naviculari-conduplicatis, carinatis, carina (villo delapso?) glabra, gluma intermedia antica, conformi, dorso (præcipue versus basin) ferruginea; glumis internis 3, parum minoribus, tenuioribus; filamentis albidis; antheris exsertis, flavidis; pistilli rudimento nullo.
*Hab.* C. B. S. Ex. sp. s. *Drège*, 11!

This plant has much of the appearance of *R. oblongus*, but differs in its smaller stature, cylindrical stems, the long threads that terminate the sheaths, the lanceolate glumes, &c. I retain this and the preceding in the genus *Restio* until the discovery of the female plants may definitely decide the question whether or not they are properly members of this genus.

R. SCOPARIUS, *Kunth, En.* iii. p. 390. n. 15; *Steudel, Synopsis,* ii. p. 251, ♀ tantum.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège,* 2495!; ♀. *Drège,* 9450! ex parte.

Plant. masc. *Culmus vaginæ*que ut in feminea. *Spiculæ* in apice ramulorum solitariæ, erectæ, lineari-lanceolatæ, 4–5 lin. long., vix 1 lin. lat. *Bracteæ* undique arcte imbricatæ, oblongæ, coriaceæ, sub apice obtusiusculo membranaceo mucronato-aristulatæ, superiores aristula destitutæ. *Flores* lanceolati, bracteis dimidio breviores. *Glumæ externæ* oblongo-lanceolatæ, laterales duo conduplicatæ, villoso-carinatæ. *Glumæ internæ* 3, oblongæ, dimidio breviores, tenuiores. *Filamenta* exigua. *Antheræ* inclusæ, lineares, flavidæ, mucronulatæ.

An sequentis forma exilis?

R. LANIGER, *Kunth, En.* iii. p. 386. n. 8; *Steudel, Synops.* ii. p. 250. n. 14, ♂ tantum.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège,* 51!; ♀. *Drège,* 36!, 2496!

In planta feminea hactenus indescripta adsunt *culmi steriles* spithamæi, teretes, exiles, medio dichotome ramosi, ramique elongati, olivacei, albo lepidoti, iterumque ramulosi, ramuli ultimi erecti, curvati, filiformes. *Vaginæ culmeæ* parvæ, arctæ, coriaceæ, superne membranaceæ, sub apice hyalino breviter foliaceo mucronatæ. *Culmi fertiles* erecti, sesquipedales, crassitie pennæ gallinaceæ, basi spatio 2–3-pollicari, vaginis ellipticis obtusis mucronulatis coriaceis spadiceis nitidis obtecti, versus medium dichotome ramosi, ramique erecti, curvati, olivacei, tuberculis parvis albidis obsiti. *Vaginæ* nisi ad ramificationes arctæ, oblongo-acutæ, coriaceæ, fuscæ, sub apice membranaceo mucronatæ, plerumque squamam alteram dorso bicarinatam, ad carinas villosam, amplectentes. *Spiculæ* in apice ramulorum solitariæ, erectæ, ovatæ, pluriflores, 3–4 lin. long., 2 lin. lat. *Bracteæ* arcte imbricatæ, ovatæ, coriaceæ, castaneæ, sub apice obtusiusculo membranaceo acuminato-mucronatæ, flores maturos oblongos stipitulatos vix æquantes. *Glumæ externæ* oblongo-lanceolatæ, rigidiusculæ, pallide ferrugineæ, laterales duæ naviculari-conduplicatæ, ad carinas ferrugineo villosæ; *gluma intermedia* antica, dorso medio superne nervo ferrugineo notata: *glumæ internæ* 3, parum breviores, latiores, conformes, ad margines involutæ. *Capsula* oblique ovata, compressa, abortu unilocularis, monosperma, castanea, superne flavida, styli brevis teretis bifidi vestigiis coronata. *Semen* magnum, trigonum, obtusum; testa cartilaginea, grisea, impresso-punctulata, purpureo maculata.

R. VILIS, *Kunth, En.* iii. p. 389. n. 13; *Steud. Synops.* ii. p. 251. n. 19.
*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 2476!

R. INTERMEDIUS, *Kunth, En.* iii. p. 388. n. 12; *Steud. Synops.* ii. p. 251. n. 18.
*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 2475! ♀. *Drège*, 197!, n. 81 pro parte!

*R. vilis* and *R. intermedius* are sometimes difficult to distinguish one from the other; in the latter plant the bracts and glumes are less acutely pointed than in *R. vilis*, and the female spikelets have usually a smaller number of perfect flowers. *R. intermedius* seems to vary considerably in the size of its spikelets and glumes.

R. VENUSTULUS, *Kunth, En.* iii. p. 388. n. 11; *Steud. Synops.* ii. p. 250. n. 17, ♂ tantum.
*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 9450! ♀. *Drège*, 1608!
Plantæ femineæ *culmus* simplex vel parce ramosus, pro ceteris ut in mare. *Spiculæ* in apice culmi 1–4, spicatim dispositæ, juniores cylindraceo-lanceolatæ, fructiferæ late ovatæ, acutæ, 3–5 lin. long., 1–2 lin. lat. *Bracteæ* arcte imbricatæ, oblongo-lanceolatæ, coriaceæ, nitidæ, striatæ, sub apice parum membranaceo haud hyalino subulato-mucronatæ, infimæ vacuæ, ceteræ fertiles flores lanceolatos pedicellatos superantes. *Glumæ externæ* ovato-lanceolatæ, rigidiusculæ, laterales duæ naviculari-conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3 vix breviores, conformes, tenuiores, postica plana, laterales ad margines superne parum involutæ. *Ovarium* oblongum, compressum, biloculare, stylo tereti bifido exserto superatum. *Capsula* oblique ovata, abortu unilocularis, coriacea, castanea, ad margines viridis, styli vestigiis coronata. *Semina* ——.

R. SUBFALCATUS, *Nees, in herb. Sonder.* Culmis sterilibus spithamæis, basi decumbentibus, squamisque laceratis sphacelatis obsitis, superne flexuosis, erectis, teretibus (crassitie pennæ corvinæ), infra medium dichotome ramosis, ramisque arcuatis, ascendentibus, superne ramulosis, ramulis curvatis, interdum fasciculatis, foliiferis; culmis fertilibus duplo longioribus, minus ramosis, plerumque aphyllis, punctulatis, viridescentibus vel stramineis; vaginis arctis, pollicaribus, ellipticis, coriaceis, striatis, ferrugineis, sub apice hyalino membranaceo mucronato-aristatis: spiculis masculis 00, erecto-patentibus, in paniculam terminalem parce diffusam dispositis, singulis cylindraceo-lanceolatis, arcuatis (3–4 lin. long., 1 lin. lat.); bracteis arcte imbricatis, ovato-oblongis, coriaceis, sub apice membranaceo subulato-mucronatis, flores arcuatos ovato-acutos duplo superantibus; glumis externis oblongo-acutis, lateralibus 2, conduplicatis, ad carinas ferrugineo villosis, intermedia antica, conformi, dorso nervo medio ferrugineo notata; glumis internis 3, parum brevioribus, conformibus, hyalinis; antheris demum exsertis, oblongis, mucronulatis: spiculis femineis 3–4, ovatis, plurifloris, in apice culmi approximatis, singulis (2–3 lin. long., 1 lin. lat.) spatha aperta ovato-acuta longe aristata munitis; bracteis glumisque externis ut in mare; glumis internis 3, quarum duæ laterales minores ad marginem anticam involutæ; ovario subgloboso, compresso, biloculari, stylo tereti (superne in ramos duos stigmatosos curvatos exsertos diviso) coronato; capsula ——.

R. subfalcatus, *N. ab E. MS. in herb. Sonder. absque descriptione.*—R. dichotomus, *Thunb. fide Nees in herb. Sonder. sed vix.*

*Hab.* C. B. S. Ex. sp. s. Olifant's River. ♂ et ♀. *Ecklon*, 76! ♂. *Drège*, 75!; *Eck. et Zeyh.* 50!

Kunth refers Drège's n. 75 doubtfully to *R. vilis.* I have preferred to follow Nees's indication, and to constitute it a new species under the name assigned to it by him in Dr. Sonder's herbarium, but nowhere published. The male plant differs from *R. vilis*, Kunth, in its more robust habit, larger size of all its parts, in the more branched and spreading panicle, the curved spikelets, &c.; the female plant differs in the larger number and different form of the spikelets and in the more acutely pointed glumes.

R. PYCNOSTACHYUS, sp. n. Culmis cæspitosis, decumbentibus, erectis, teretibus, sterilibus spithamæis, infra medium dichotome ramosissimis, ramulis arcuatis, foliiferis, arbusculam pyriformem mentientibus, fertilibus simplicibus, aphyllis, duplo vel triplo longioribus, stramineis, impresso-punctulatis; vaginis arctis, ellipticis, coriaceis, ferrugineis, sub apice membranaceo aristatis: spiculis masculis 00, in paniculam erectam terminalem latam approximatis, singulis cylindraceo-lanceolatis, arcuatis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, late ovatis, acutis, flores vix superantibus; glumis externis 3, oblongo-acutis, lateralibus conduplicatis, villoso carinatis; glumis internis conformibus, minoribus, membranaceis; filamentis complanatis, albidis; antheris oblongis, ferrugineis, mucronulatis, demum exsertis. Feminea ignota.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 79!

In one of the specimens examined by me, the pyramidal tuft of leaf-bearing branchlets was borne on a long erect culm like the fertile one.

R. NEESII, sp. n. Culmis (sesquipedalibus) erectis, teretibus (crassitie pennæ gallinaceæ), basi vaginis ovatis castaneis coriaceis approximatis obtectis, infra medium dichotome ramosis, hisque erectis, ascendentibus, stramineis, minutissime impresso-punctulatis, aphyllis; vaginis culmeis arctis, oblongis, coriaceis, striatis, albo tuberculatis, ferrugineis, sub apice obtusiusculo fusco membranaceo mucronato-subaristatis: spiculis masculis 00, in paniculam densam cymosam terminalem unguicularem dispositis, singulis ovatis, erectis patentibusve, plurifloris (1 lin. long., vix ½ lin. lat.), spatha aperta brevi vaginæformi suffultis; bracteis arcte imbricatis, ovatis, coriaceis, ferrugineis, nigrescentibus, marginibus superne membranaceis, sub apice subulato-mucronatis, flores oblongos superantibus; glumis externis oblongis, obtusiusculis, lateralibus duabus conduplicatis, ad carinas ferrugineo villosis; glumis internis conformibus, externas paulo superantibus, dorso superne parum ferrugineis, membranaceis; filamentis complanatis, albidis; antheris lineari-lanceolatis, apiculatis. Plantæ femineæ culmo vaginisque ut in mare nisi magnitudine majoribus; spiculis 3–5 in paniculam latam simplicem terminalem dispositis, singulis ovatis, demum clavatis (2–3 lin. long., 1–2 lin. lat.), 2–3-flor.; bracteis arcte imbricatis, masculinis omnino similibus, nisi magnitudine majore substantiaque rigidiore; glumis externis oblongo-acutis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumarum interiorum longitudine eadem ac glumarum externarum, lateralium marginibus superne involutis, postica planiuscula; ovario oblongo, compressiusculo, stylo brevi tereti crasso bifido superato; capsula oblique ovata, uniloculari, ad latus rima longitudinali dehiscente, styli vestigiis coronata, glumis persistentibus obtecta.

*Hab.* C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 72. 11! ♀. *E. et Z.* i. 12!

At first sight the male plant greatly resembles some forms of *R. Gaudichaudianus*, Kunth; but it is readily distinguishable by the characters afforded by the sheaths, glumes, &c.

In Dr. Sonder's herbarium the male and female plants have attached to them the name of *R. bifurcus*, Nees von Esenb., in the handwriting of that botanist; but as that author has applied the same name to an entirely different species, in the before-mentioned collection, I venture to attach to the above-described plant a different appellation, and one which will be significant of the recognition of the plant as a distinct species by the learned author above named.

R. HELENÆ, sp. n. Culmis sterilibus pedalibus et ultra, decumbentibus, basi vaginis ellipticis coriaceis castaneis approximatis obsitis, infra medium dichotome ramosis, ramisque compressis, olivaceis, albo tuberculatis, iterum ramulosis, ramulis ultimis elongatis, flexuosis, ascendentibus; culmis fertilibus teretibus, 2–3-pedalibus, stramineis vel juventute olivaceis, superne parum ramosis, ramis dichotomis fasciculatisve; vaginis arctis, ellipticis, coriaceis, cuspidatis, ad margines superne membranaceis, vaginis ramularibus sub apice bifido membranaceo foliaceo-mucronatis: spiculis masculis pluribus, ad apicem culmi, in paniculam magis minusve ramosam approximatis, singulis cylindraceo-lanceolatis, erectis, arcuatis (4–5 lin. long., 1 lin. lat.), spatha aperta bracteiformi suffultis; bracteis arcte imbricatis, oblongis, acuminatis, coriaceis, ferrugineis, ad margines superne membranaceis, flores oblongos superantibus; glumis externis oblongis, obtusis, chartaceis, lateralibus duabus naviculari-conduplicatis, ad carinas ferrugineo villosis, intermedia dorso medio superne nervo ferrugineo notata; glumis internis tribus parum brevioribus, latioribus, hyalino-membranaceis; filamentis complanatis, antheris denique exsertis: spiculis femineis ut videtur solitariis, erectis, cylindraceo-oblongis, plurifloris (8–10 lin. long., 1 lin. lat.); bracteis glumisque ut in mare, nisi magis acutis; glumis internis lateralibus ad margines superne parum involutis, postica plana; ovario rotundato, compresso, stylis duobus elongatis superato; capsula ——.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, n. 1616.

Closely allied to *R. triflorus*, but readily distinguished by its larger size, the acuminate bracts, and obtuse glumes.

R. TRIFLORUS, *Rottb. Desc. Gram.* p. 3, t. 2. f. 2 (♂); *Thunb. Prod.* p. 15; *Diss.* p. 16. n. 16; *Fl. Cap.* i. p. 86. n. 17; *Spreng. Syst. Veg.* i. p. 185. n. 27; *Kunth, En. Plant.* iii. p. 391. n. 17, quoad pl. femineam.—R. dichotomus, *Thunb.* var. β. culmo simplici, *fide Nees ab Esenb. in Linnæa*, v. p. 641.—R. Kunthii, *Steud. Synops.* ii. p. 251. n. 26.

*Hab.* C. B. S. Ex. sp. s. ♂. *Dr. Maton in herb. Mus. Brit.*!; *Eck. et Zeyh.* 54. 7. (April.–Decemb.!) ♀. Table Mountain, *Eck. Un. It.* n. 845!; Tulbagh, 56. 5!; *Zeyher*, 4342!; *Sieber, Fl. Cap.* 115! ♂ et ♀. *Drège*, n. 69!

Nees himself has assigned the name *R. dichotomus* to several very different plants in Dr. Sonder's herbarium; hence I have preferred to keep Rottboell's species intact, being the more inclined to do so from the excellent figure he has left us in the work referred to. Steudel's *R. Kunthii* is in no way distinguishable from *R. triflorus*, Rottb. Kunth does not appear to have seen male plants of this species—the only ones, however, described by Rottboell.

R. WALLICHII, sp. n. Rhizomate repenti, squamis coriaceis castaneis obsito; culmis erectis (bipedalibus), infra medium dichotome ramosis, ramisque ascendentibus, strictis, compressiusculis, viridescentibus, minutissime impresso-punctulatis; vaginis oblongis, obtusis, coriaceis, ferrugineis, sub apice obtuso vix membranaceo subulato-mucronatis, aphyllis; spiculis 6–8, plurifloris, in apice ramulorum per paniculas lineares (bipollicares) distiche dispositis, singulis erectis vel erecto-patentibus, cylindraceo-lanceolatis, spatha bracteiformi suffultis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongis, obtusis, coriaceis, nervoso-striatis, sub apice obtuso membranaceo mucronato-subulatis, flores lanceolatos superantibus; glumis externis rigidiusculis, lanceolatis, acutatis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis 3, dimidio minoribus, ovato-lanceolatis,

membranaceis, maculis ferrugineis notatis; ovario subgloboso, compressiusculo, biloculari, stylo brevi tereti superato; stigmatibus duobus, linearibus, curvatis, exsertis; capsula ——.

*Hab.* C. B. S. Ex. sp. s. ♀. *Wallich, sine numero in herb. Hook. aliorumque!*

There can be little doubt that this very distinct-looking species is a true *Restio*, although none of the specimens that have come under my observation have had the fruit sufficiently matured to decide the point with certainty.

R. MACER, *Kunth, En.* iii. p. 390. n. 14; *Steudel, Synops.* ii. p. 251. n. 20.—R. limbatus, *Nees, MS. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 2487!; *Eck. et Zeyh.* l. 11, pro parte! ♀. *Eck.* 84 partim!

Plantæ femineæ cl. Kunthio incognitæ characteres adjicio. *Culmus vaginæ*que ut in mare. *Spiculæ* in apice ramorum 3–5, erecto-patentes, in paniculam simplicem dispositæ, singulæ cylindraceo-lanceolatæ, unguiculares, 1 lin. lat., pluriforæ. *Bracteæ* arcte imbricatæ, oblongæ, coriaceæ, fuscæ, sub apice obtuso profunde hyalino membranaceo subulato-mucronatæ, infima vacua spathacea, spicula vix dimidio brevior; ceteræ fertiles, flores oblongo-lanceolatos stipitatos paulo superantes. *Glumæ externæ* lanceolatæ, laterales conduplicatæ, ad carinas ferrugineo villosæ. *Glumæ internæ* minores, conformes, lateralium marginibus anticis parum involutis. *Ovarium* rotundatum, compressum, biloculare, stylo tereti longiusculo apice bifido exserto superatum. *Capsula* compressa, ovata, bilocularis, lateraliter dehiscens, styli vestigiis coronata, glumis persistentibus obtecta.

In Dr. Sonder's herbarium the male plant of this species is labelled *R. microstachyus β. humilis* by Nees. It differs, however, greatly from other specimens bearing this name, and which I have elsewhere referred to *R. Gaudichaudianus*, Kunth. The female plant in the above-named herbarium is labelled by the same distinguished botanist as *R. limbatus*, N. ab E. MS.; but as there can be little or no doubt that it is the female plant of Kunth's *R. macer*, I have retained the published name of the latter author.

R. SIEBERI, *Kunth, En.* iii. p. 387. n. 9; *Steud. Synops.* p. 250. n. 15.

*Hab.* C. B. S. Ex. sp. s. ♂. *Masson*!; *Sieber*, 228! sub nom. *R. triflori.* ♀. *Drège*, 9615!; 47 pro parte!; 81!

Plantæ femineæ characteres adjicio. *Culmus vaginæ*que ut in mare. *Spiculæ fructiferæ* 1–5, late ovatæ, 3–4-floræ, 3 lin. long., 2 lin. lat. *Bracteæ* arcte imbricatæ, late ovatæ, coriaceæ, ferrugineæ, sub apice membranaceo mucronatæ, flores maturos haud æquantes. *Glumæ* omnes rigidiusculæ, oblongo-acutæ, pallide ferrugineæ, laterales *externæ* naviculari-conduplicatæ, carinis (villis delapsis) glabris. *Glumæ*

*internæ* parum breviores. *Capsula* oblique ovata, unilocularis, coriacea, ferruginea, ad latus longitudinaliter dehiscens, styli vestigiis superata. *Semen* magnum; testa grisea, tuberculis parvis obsita.

R. ECKLONII, sp. n. Culmis cæspitosis (pedalibus), teretibus, erectis, flexuosis, rigidiusculis, infra medium di- vel trichotome ramosis, ramisque interdum fasciculatim ramulosis, ramulis erectis, arcuatis, stramineis, sulcatis, minutissime tuberculatis; vaginis arctis, tubulosis, coriaceis, ferrugineis, sub apice obtuso membranaceo subulato-mucronatis, mucrone plerumque reflexo: spiculis masculis 6–8, in apice ramulorum spicatim dispositis, singulis erectis, subcompressis, cylindraceo-lanceolatis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongo-obtusis, coriaceis, pallide ferrugineis, sub apice obtuso membranaceo longiuscule mucronatis, flores oblongo-lanceolatos superantibus; glumis externis oblongo-lanceolatis, chartaceis, lateralibus conduplicatis, ad carinas pallide ferrugineo villosis; glumis internis conformibus, parum brevioribus, hyalinis; antheris linearibus, apiculatis, pallidis. Femina latet.

*Hab.* C. B. S. Ex. sp. s. ♂. *Ecklon*, 85!; *Eck. et Zeyh.* 55. 8!; ?*Drège*, 2497!

The compressed spikelets, obtuse ends of the oblong bracts, and the narrow, pointed, papery glumes afford good points whereby to discriminate this species. Drège's 2497, of which I have only seen a small fragment, seems very like the above, but the spikelets are much larger.

In Dr. Sonder's herbarium the plant appears under the name of *R. dichotomus*, Thunb., and *R. bifidus* var. β, N. ab E.; in the latter case with a doubt, thus expressed by Nees himself, "an propria species?" As it has nothing to do with either of the plants just named, and as it seems distinct, I have dedicated it to its discoverer.

R.? DIVARICATUS, sp. n. Culmo, ut videtur, pedali et ultra, erecto, tereti, supra medium dichotome ramoso, ramisque longiusculis, erecto-patentibus, cinnamomeo-fuscis, albo tuberculatis; vaginis arctis, tubulosis, unguicularibus, fuscis, coriaceis, albo tuberculatis, sub apice obtuso membranaceo haud hyalino mucronato-aristatis; spiculis 6–8, plurifloris, erectis, in apice ramorum approximatis, spicatim dispositis, singulis ovato-lanceolatis (2–3 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, ovatis, lanceolatis, subcoriaceis, fuscis, maculatis, sub apice membranaceo obtuso longiuscule aristatis, flores ovatos fere duplo superantibus; glumis externis ovato-oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis minoribus, conformibus, hyalinis; antheris oblongis, apiculatis, flavidis. Femina latet.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 2490!

Apparently a very distinct species. I have, however, only been enabled to examine imperfect specimens, and do not know the female plant. The small spikelets disposed in linear spikes, the lanceolate aristate bracts surmounting the florets, and the broad glumes supply good means of recognition.

### B. *Spiculæ femineæ pauciflora.*

### * *Styli 2 distincti.*

R. LEPTOSTACHYUS, *Kunth, En.* iii. p. 407. n. 40; *Steud. Synops.* ii. p. 254. n. 53.

*Hab.* C. B. S. Ex. sp. s. *Drège,* 12, ♂ et ♀!

A cl. Kunthio planta mascula solum descripta. In stirpibus femineis adsunt *culmi vaginæ*que ut in mare. *Spiculæ* 2–4 in apice ramulorum parum remotæ, distiche spicatimque dispositæ, singulæ cylindraceo-lanceolatæ, fructiferæ oblongæ, pyramidales, biflorae, 3–5 lin. long., 2–3 lin. lat. *Bracteæ* quoad formam ut in mare, basi in internodium spiculæ ita decurrentes ut hoc utrinque alatum. *Glumæ* ut in mare. *Ovarium* stipitulatum, subclavatum, biloculare, stylis duobus distinctis, intus stigmatosis, inclusis superatum. *Capsula* oblique elliptica, abortu unilocularis, lateraliter dehiscens, glumis persistentibus internis dimidio brevior.

R. DEPAUPERATUS, *Kunth, En.* iii. p. 405. n. 37; *Steud. Synops.* ii. p. 253. n. 50.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège,* 2021 ex parte! ♀. *Drège,* n. 10!

### ** *Styli 2 connati.*

R. CAPILLARIS, *Kunth, En.* iii. p. 405. n. 36; *Steud. Synops.* ii. p. 253. n. 49.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège,* 9! ♂ et ♀. *Drège,* n. 339!

R. GAUDICHAUDIANUS, *Kunth, En.* iii. p. 387. n. 10; *Steud. Synops.* ii. p. 250. n. 16.

*Hab.* C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 1. 11!; 1. 12! in herb. Sonder. sub nom. cl. Neesio dato *R. microstachyi.* *Eck.* 81!; *Pappe,* 78!; *Drège,* 52!, 1619! ♀. *Drège,* 58!

Plantæ femineæ cl. Kunthio indescriptæ characteres adjicio. *Culmus, rami vaginæ*que ut in mare. *Spiculæ* in apice culmi plerumque binæ, 1–2-floræ, erectæ, sessiles vel breviter pedicellatæ, singulæ ovato-oblongæ, acutæ, fructiferæ subclavatæ, 1–2 lin. long., ½–1 lin. lat. *Bracteæ* arcte imbricatæ, late ovatæ, acutæ, coriaceæ, castaneæ, sub apice breviter mucronatæ, infimæ vacuæ, fertiles flores subæquantes. *Flos* maturus plerumque solitarius, oblongus, pedicellatus. *Glumæ externæ* oblongo-acutæ, rigidæ, subferrugineæ, convexæ, laterales duæ conduplicatæ, villoso carinatæ. *Glumæ internæ* vix breviores, conformes, rigidiusculæ, ferrugineæ. *Ovarium* rotundatum, compressum, uniloculare, stylo crasso tereti apice bifido superatum. *Capsula* oblique ovata, abortu uniloculari, coriacea, ferruginea, ad marginem dehiscens, styli vestigiis coronata, glumisque persistentibus obtecta. *Semen* magnum, ovato-oblongum; testa cinerea, micans, impresso-punctulata, maculis purpureis obsita.

The male plants vary considerably in habit and stature; the spikelets on the same specimen frequently differ considerably in size, and to a less degree in form; the shape of the bracts, glumes, &c., remains constant; the smaller sheaths are frequently close, but the larger ones always lax. In the female plant the spikelets have generally but one perfect flower, and are frequently the subjects of lateral leafy prolification.

R. Eleocharis, *N. ab E. MS.* Culmis sesquipedalibus, erectis, teretibus (crassitie pennæ corvinæ), basi spatio 4-pollicari vaginis spadiceis nitidis approximatis vestitis, medio dichotome ramosis, ramis elongatis, erectis, filiformibus, virgatis, prope basin ramulosis, aphyllis; vaginis arctis, ellipticis, coriaceis, striatis, marginibus parum membranaceis, sub apice membranaceo mucronulatis; spiculis masculis in apice ramulorum solitariis, ellipticis, acutis, erectis, plurifloris (2–4 lin. long., ½ lin. lat.); bracteis arcte imbricatis, oblongis, coriaceis, ferrugineis, sub apice membranaceo mucronatis, flores ovato-lanceolatos breviter stipitatos paulo superantibus; perianthii segmentis externis rigidis, oblongis, lateralibus conduplicatis, ad carinas ferrugineo villosis, segmentis internis paulo brevioribus, oblongis, æqualibus, subhyalinis, dorso superne ferrugineo maculatis; filamentis ligulæformibus, albidis; antheris linearibus, dorso ferrugineis, apiculatis, demum exsertis. Femineæ culmo habitu parum robustiore, spiculis in apice ramulorum solitariis, bifloris, ovatis, erectis, plurifloribus (1–2 lin. long., vix 1 lin. lat.); bracteis ut in mare; glumis externis rigidiusculis, ovato-lanceolatis, superne parum ferrugineis, lateralibus conduplicatis, ad carinas paulum ferrugineo villosis; glumis internis 3 conformibus, vix brevioribus, tenuioribus, ad margines superne parum involutis; ovario oblongo, compresso, biloculari, ferrugineo, stylo brevi tereti apice bifido coronato. Fructum non vidi.

R. Eleocharis, *N. ab E. in herb. Sonder. absque descriptione.*

*Hab.* C. B. S. Ex. sp. s. ♂. In planitie Capensi, *Ecklon*, 1 et 560!; *Drège*, 2489! ♀. Zeekoe Valley, 78! 894! (Maii).

R. monanthos, sp. n. Culmis erectis, teretibus, sesquipedalibus (crassitie pennæ corvinæ), parce dichotome ramosis, ramisque ascendentibus, stramineis, impresso-punctulatis, aphyllis; vaginis nisi ad ramificationes arctis, ellipticis, coriaceis, striatis, ferrugineis, sub apice obtuso ferrugineo subulato-mucronatis: spiculis femineis 6–8, in apice ramulorum parum approximatis, spicatim dispositis, singulis subglobosis (magnitudine nuclei cerasi), unifloris; bracteis arcte imbricatis, ovatis, coriaceis, fuscis, sub apice parum membranaceo acutiusculo subulato-mucronatis: flore femineo solitario (an semper?) bractea stipante vix breviore; glumis externis oblongis, rigidis, ferrugineis, lateralibus naviculari-conduplicatis, ad carinas ferrugineo villosis; glumis internis parum minoribus, late ovatis, obtusiusculis, membranaceis, ferrugineis, lateralium marginibus superne parum involutis; ovario ovato-oblongo, compresso, biloculari, ferrugineo, stylo tereti bifido superato; capsula biloculari (an semper?), ad margines dehiscente, ultra glumas marcescentes producta; seminibus ——.

*Hab.* C. B. S. Ex. sp. s. *Drège*, 2486, ♀!

R. ROTTBOELLOIDES, *Kunth, En.* iii. p. 394; *Steudel, Synops.* ii. p. 252. n. 32.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 2494!

The female flowers in this species are destitute of a perianth, the ovary being subtended by a sheathing bract.

R. GRAMINIFOLIUS, *Kunth, En.* iii. p. 407. n. 49; *Steudel, l. c.* 254. n. 52.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 2021!

This species is noteworthy for its well-marked foliage, its pedicellate spreading spikelets, and the cellular cushion-like pads placed in the forks of the pedicels.

R. LUDWIGII, *Steudel.* CHAR. EMEND.—Radicibus simplicibus, flexuosis, lignosis, horizontaliter patentibus; culmis pluribus, cæspitosis, erectis, teretibus, spithamæis et ultra, crassitie pennæ passerinæ, basi squamis approximatis castaneis ovatis coriaceis striatis obtectis, versus medium di- vel trichotome ramosis, ramisque filiformibus, erecto-patentibus, flexuosis, tuberculis albis obsitis, aphyllis; vaginis nisi ad ramificationes arctis, coriaceis, ellipticis, sub apice obtusiusculo membranaceo breviter subulato-mucronatis: spiculis masculis solitariis vel binis, in apice ramulorum erectis, ovatis, 1–2-floris (singulis 1 lin. long., vix 1 lin. lat.), spatha aperta vaginæformi suffultis; bracteis laxe imbricatis, oblongis, obtusis, coriaceis, tuberculatis, sub apice parum membranaceo valide subulato-mucronatis, flores lanceolatos vix superantibus; glumis externis oblongis, obtusis, submembranaceis, lateralibus conduplicatis, ad carinas subvillosis; internis conformibus, vix brevioribus, hyalino-membranaceis; filamentis albidis, complanatis; antheris lineari-oblongis, apiculatis, flavidis, exsertis: spiculis femineis 1–2, in apice ramulorum erectis, oblongis, demum pyriformibus, clavatis nutantibusque; bracteis laxe imbricatis (quoad formam ut in mare), floribus solitariis vel binis; glumis externis oblongo-lanceolatis, membranaceis, lateralibus conduplicatis, ad carinas villosulis; glumis internis 3, brevioribus, obtusis, hyalinis, marginibus superne stylum obvolventibus; ovario rotundato, compresso, biloculari, ferrugineo; stylo longo, tereti, ad basin dilatato, ibique flavo, superne in ramos stigmatosos duos revolutos exsertos diviso; capsula oblique ovata, abortu uniloculari, styli vestigiis notata, glumas persistentes superante.

R. Ludwigii, *Steud. Syn.* ii. p. 254.—R. nutans, *Steud.* (nec *Thunb.*) *Flora,* 1829, p. 134.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. Hottentotshollandberg, *Eck. et Zeyh.* 5, 6, 11!; 135! ♀. *Ludwig in herb. Fielding.*!; *Eck.* 83! 85! (fl. Oct., Nov.)

R. CINCINNATUS, sp. n. Culmo pedali et ultra, erecto, tereti (crassitie pennæ gallinaceæ), basi squamis laceratis approximatis obtecto, versus medium dichotome subfasciculatimve ramoso, ramis elongatis, erecto-patentibus, curvatis, apice subcincinnatis vel strictis, aphyllis; vaginis arctis, oblongis, coriaceis, ferrugineis, striatis, albo tuberculatis, sub apice obtuso membranaceo demum bilobato laceratove mucronato-subulatis: spiculis masculis cylindraceo-lanceolatis (2–3 lin. long., 1 lin. lat.), in apice ramulorum solitariis vel binis, plurifloris; bracteis arcte imbricatis, ovatis, acutis, coriaceis, sub apice membranaceo breviter mucronatis, flores oblongos superantibus; glumis externis oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis minoribus, conformibus, tenuioribus; staminibus 3, filamentis complanatis, latiusculis; antheris oblongis, flavidis, apiculatis: spiculis femineis in apice ramulorum solitariis vel binis, oblongo-lanceolatis, strictis vel leviter arcuatis, erectis (fructiferis subclavatis, nutantibus), unifloribus (1–2 lin. long., ½ lin. lat.); bracteis arcte imbricatis, ovato-acutis, coriaceis, sub apice membranaceo subulatis; flore unico bractea stipante vix breviore, ovato, nec compresso; glumis externis oblongis, obtusis, lateralibus conduplicatis, ad carinas ferrugineo villosis, intermedia superne ad margines parum involuta; glumis internis 3 conformibus, stylum obvolventibus; ovario rotundato, biloculari, basi castaneo, superne flavo, stylo brevi tereti apice bifido superato; capsula oblique ovata, subcompressa, abortu 1-loculari, ad marginem rima longitudinali dehiscente, styli vestigiis coronata, glumis marcescentibus vix breviore.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 75. 5!

This plant was considered by Nees von Esenbeck to be referable to *R. Ludwigii,* Steudel, and, in accordance with that opinion, is so named by Nees himself in Dr. Sonder's herbarium. A comparison of the plant, however, with an authentic specimen of *R. Ludwigii,* Steud., in the Fielding herbarium, shows that the two plants, though very closely allied, yet belong to different species, or at least must be considered to do so till further evidence may supply intermediate links between the two. The present species differs from *R. Ludwigii,* Steud., in the larger size of all its parts, in the many-flowered male spikelets, in the more acuminate form of the bracts, in their shorter points and closer disposition. The

glumes, on the other hand, especially in the female plant, are not so sharply pointed as in *R. Ludwigii*, Steud.

R. CURVIRAMIS, *Kunth, En.* iii. p. 395. n. 23; *Steud. Synops.* ii. p. 252. n. 33.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, nn. 54!, 57!, 70!, 1626!, 2498!; *Ecklon et Zeyher*, 1, 11, pro parte. In herb. Sonder. sub nom. cl. Neesio dato *R. microstachyi β. humilis.*

This species seems to be variable in the size of the culms, spikelets, &c., and to a smaller extent in the shape of the bracts and glumes; but as on the same specimen instances of these differences in form are met with, it is obvious that they do not warrant the formation of more than one species.

R. TENUISSIMUS, *Kunth, En.* iii. p. 394; *Steudel, Synops.* ii. p. 252. n. 31.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 1625!; *Dr. Thom in herb. Hook.* 1027! ♂ et ♀. *Drège*, 1970!

This species is remarkable for the reduction in the number of its parts. In both the male and female plants there is but a single flower enveloped by two bracts; there are four glumes only, the two stamens in the male plant being placed opposite to the two inner glumes.

R. LEPTOCLADOS, sp. n. Culmo erecto, tereti, bipedali, basi spatio tripollicari vaginis coriaceis destructis nigrescentibus obsito, superne remote vaginato, olivaceo, impresso-punctulato, versus medium ad vaginas verticillatim ramoso, ramisque filiformibus, elongatis, erecto-patentibus, tuberculis albidis præditis; vaginis culmeis arctis, ellipticis, coriaceis, destructis, rameis ellipticis, sub apice membranaceo longe acuminatis; spiculis in apice ramulorum solitariis, ovatis, acutis (1–1½ lin. long., ½ lin. lat.), fructiferis cuneatis unifloribus; bracteis arcte imbricatis, ovato-oblongis, coriaceis, sub apice membranaceo subulato-mucronatis; flore (ut videtur) solitario, bractea stipante vix breviore; glumis externis lineari-oblongis, medio dorso villoso carinatis, lateralibus conduplicatis; glumis internis tribus vix brevioribus, conformibus, ad margines superne parum involutis pallideque ferrugineis; ovario oblongo, compresso, biloculari, stylo brevi tereti apice bifido superato; capsula oblique ovata, abortu uniloculari, rima longitudinali dehiscente. Masc. ignot.

*Hab.* C. B. S. Ex. sp. s. ♀. *Drège*, 3!

This species has much of the habit of some of the forms of *R. subverticillatus*, but is readily distinguished from it by the much more oblong form of the bracts, glumes, the presence of only a solitary floret in each spikelet, &c.

SECT. II. *Stigmata* 3 *subsessilia, distincta, villoso-plumosa. Staminodia ligulæformia vel rarissime nulla. Pistilli rudimentum (in flor. masc.) trigonum.*

* *Culmi plerumque teretes.*

R. STROBILIFER, *Kunth, En.* iii. p. 389. n. 25; *Steud. Synops.* ii. p. 252. n. 38.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège,* 2474! ♂. *Wallich in herb. Hook.*! False Bay, *Robertson in herb. Mus. Brit.*!

R. PACHYSTACHYUS, *Kunth, En.* iii. p. 399. n. 6; *Steudel, Synops.* ii. p. 252. n. 37.

*Hab.* C. B. S. Ex. sp. s. *Drège,* 43, ♀!

R. FURCATUS, *Nees, MS.* (absque descriptione). Culmo ut videtur erecto, tereti, 2–3-pedali, dichotome ramoso, ramisque olivaceis, tuberculis albis obsitis, superne parum dichotome ramulosis; vaginis arctis, ellipticis, acutis, coriaceis, fuscis, striatis, superne fusco membranaceis, lacerato-destructis, squamam alteram obtusam dorso bicarinatam amplectentibus; spiculis masculis 8–10, in paniculam terminalem parum ramosam approximatis, singulis erectis, ovatis, acutis (3–4 lin. long., 1 lin. lat.); bracteis undique arcte imbricatis, ovatis, coriaceis, nervoso-striatis, ferrugineis, sub apice fusco membranaceo subulato-mucronatis, flores oblongo-ovatos superantibus; glumis externis oblongis, rigidis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis tribus, parum brevioribus, hyalinis, basi incrassatis; filamentis complanatis; antheris ovatis, apiculatis, dorso ferrugineis; pistilli rudimento minuto, trigono.

R. furcatus, *Nees, MS. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.*!

R. QUINQUEFARIUS, *Nees ab Esenb. Linnæa,* v. p. 639 (1830); *Steud. Synops.* ii. p. 253. n. 48.—R. xyridioides, *Kunth, En.* iii. p. 397. n. 24.

*Hab.* C. B. S. Ex. s. sp. ♂. In planitie Capensi, *Ecklon,* nn. 564!, 564 *b*!, 565!, 566!; *Eck. et Zeyh.* 78. 8! ♀. False Bay, *Robertson*!, *Lind*!; Wynberg (Aug. c. fr. mat.), *Eck.*! et sub n. 91!; Simon's Town, *C. Wright in herb. Coll. Trin. Dubl.* n. 484! ♂ et ♀. *Drège,* 35!; Cape Town, *Harvey,* 372!

This species varies considerably in size and degree of branching, and to a less extent in the form of the spikelets and in their number, but in all essential points there is too close a resemblance to allow of the species being broken up, especially as numerous intermediate links between extreme forms can be found.

R.? PUNCTULATUS, *Nees, MS.* Culmis sesquipedalibus, decumbentibus, teretibus vel subcompressis (crassitie pennæ corvinæ), prope basin dichotome ramosis, ramisque erectis, olivaceis, albo tuberculatis;

vaginis arctis, ellipticis, coriaceis, striatis, superne profunde hyalino-membranaceis, sub apice acuto subulato-mucronatis; spiculis 1–4, in apice ramorum parum remotis spicatimque dispositis, singulis oblongis, acutis, erectis, plurifloris (6–7 lin. long., 1 lin. lat.), spatha aperta vaginæformi præditis; bracteis imprimis arcte, demum laxe imbricatis, lanceolatis, coriaceis, ferrugineis, marginibus superne membranaceis, basi decurrentibus, flores oblongos trigonos arcuatos triplo superantibus; glumis externis æqualibus, rigidiusculis, oblongis, obtusiusculis, lateralibus conduplicatis, carinatis, carina ala membranacea lacerata prædita; glumis internis inter se æqualibus, externis paulo brevioribus, ovato-lanceolatis, subhyalinis, ima basi connatis; staminodiis nullis; ovario cuneato, trigono, subferrugineo, biloculari, stigmatibus tribus villoso-plumosis coronato; fructu ——.

R. punctulatus, *Nees, MS. absque descrip. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. ♀. Pampoes Kraal, *Zeyher*, 1737!

The specimens hitherto examined have been too imperfect to allow of the exact structure of the ovary and fruit being satisfactorily made out; hence Nees's indication is here provisionally adopted, not without a strong suspicion that the plant will ultimately be placed in the genus *Calopsis*.

R. DISTICHUS, *Rottb. Progr.* p. 11; *Descr. et Ic. Gram.* p. 6. n. 6, t. 2. f. 5; *Willd. Sp. Pl.* iv. 2. p. 275; *Spreng. Syst. Veg.* i. p. 185. n. 32; *Nees ab Esenb. Linnæa*, v. p. 637; *Kunth, En.* iii. p. 409. n. 45; *Steudel, Synops.* ii. p. 254.

Femina latet.

*Hab.* C. B. S. Ex. sp. s. ♂. Tulbagh (Nov.), *Zeyher* (n. 35?)!; Witsenberg (Dec.), *Zeyher*, 1737!; *Eck. et Zeyh.* 1. 12!, 77. 9! In monte Tabulari, *Ecklon, sine numero*!

Rottboell's description and figure amply suffice for the discrimination of this species, of which Nees also has (*l. c.*) given a good account. The number of spikelets, however, is variable, even on the same specimen. One of the outer glumes is frequently larger than the rest; but this is not constant, and the presence of ferruginous hairs on the outer glumes is equally variable. The confluence of the inner glumes at the base is a noteworthy characteristic in this species. Sprengel, without due reason apparently, refers Thunberg's *R. cuspidatus* to this species. In Dr. Sonder's herbarium one of the specimens received from Zeyher is named by Nees *R. punctulatus* var. *gracilis*, but it differs considerably from other plants so named by the same botanist.

R. TRITICEUS, *Rottb. Progr.* p. 11; *Descr. et Ic.* p. 7, t. 3. f. 1; *Thunb. Diss.* p. 17. n. 18; *Fl. Cap.* i. p. 87. n. 22; *Willd. Sp. Pl.* iv. 2. p. 726. n. 22; *Spreng. Syst. Veg.* i. p. 185. n. 29; *Nees ab Esenb. Linnæa,*

v. p. 640 (pro parte).—R. triticeus β. gracilis, *Nees, in herb. Sonder.* —Calopsis triticea, *Kunth, En.* iii. p. 424; *Steudel, Synops.* ii. p. 258. n. 3.—R. glumaceus, *Klotsch, in herb.*

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. False Bay, *Robertson*!; *Alström*!; *Sieber, Fl. Mixta,* 11, ♂!; *Fl. Cap.* 112, ♀!; *Bergius,* ♀!; *Eck. Un. It.* 844, ♂!; *Eck. et Zeyh.* nn. 4. 7, 105. 3, ♂ et ♀!; *Zeyher,* ♂ et ♀, 1742!; *Drège,* 9451, 85, ♂!; *Wright in herb. Coll. S. Trin. Dubl.* n. 495, ♀! (fl. April.); *Dr. Thom,* 1026, ♂!

This species is well described and figured by Rottboell, with the exception of the pistil, which he speaks of and represents as triangular, thus inducing Kunth to place it under *Calopsis.* It is of course possible that what I have here considered to be the female plants of this species are different from those intended by Rottboell. All I can say is that they correspond in all particulars with the male plants, and the structure of their ovaries and capsules shows them to be indubitably members of this genus. The transverse attachment of the spikelets, whose backs are thus parallel to the rachis as in *Triticum,* not edgewise as in *Lolium,* the oblong form of the bracts, which exceed the florets considerably in size, and the pinkish tinge of the inner glumes suffice to distinguish this species. The seeds are large, and studded with large pearl-like tubercles. Some of the specimens have simple fertile culms twice the length of the sterile ones, which latter are erect, dichotomously branched, with very numerous erect, rather rigid branchlets; the sheaths have a leafy tip and are studded with white tubercles. Specimens such as these are noted by Nees as *R. triticeus* var. β. *gracilis.*

R. MULTIFLORUS, *Spreng. Syst. Veg.* i. p. 187. n. 52; *Nees ab Esenb. Linnæa,* v. p. 646; *Kunth, En.* iii. p. 412. n. 31; *Steud. Synops.* ii. p. 254. n. 59.—R. triticeus β. foliosus, *N. ab E. Linnæa,* v. p. 640.—R. triticeus destructus, *N. ab E. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. In monte Diaboli (Dec.), *Eck. et Zeyh.*!; Table Mt., *Eck.*!; Lion's Mt., *Mundt,* n. 91, ♀!; *Drège,* n. 90, ♀!

This species differs from *R. triticeus* in the form of the spikelets, in their being placed edgewise to the rachis, as well as in the more pointed form of the bracts.

R.? PANNOSUS, sp. n. Culmo erecto, tereti, 2–3-pedali (crassitie pennæ gallinaceæ), infra medium dichotome ramoso, ramisque ascendentibus, elongatis, virgatis, simplicibus, aphyllis, olivaceis, albo tuberculatis; vaginis arctis, ellipticis, longissime acuminatis, coriaceis, fuscis, marginibus superne profunde hyalino-membranaceis, dilaceratis; spiculis 7–12, in paniculas elongatas simplices terminales dispositis, singulis erectis vel leviter arcuatis, cylindraceo-oblongis, plurifloris, spatha aperta vaginæformi suffultis (3–4 lin. long., 1 lin. lat.); bracteis arcte imbricatis, oblongis, coriaceis, ferrugineis, sub apice parum membranaceis, breviter mucronatis, flores oblongos subtrigonos breviter stipitatos parum superantibus; glumis externis oblongis, rigidiusculis, subfuscis, lateralibus conduplicatis, ad carinas parce villosis; glumis internis tribus, vix brevioribus, hyalinis, ima basi connatis, inæqualibus, postica latiore; antheris linearibus, apiculatis, ferrugineis; pistilli rudimento minuto, tristylo; ovario cuneato, subcompresso, purpureo, margine viridescente, stigmatibus villoso-plumosis coronato, ad basin staminodiis tribus ligulæformibus circumdato; fructu ——.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. False Bay, *Robertson*!; *Eck. et Zeyh.* 78. 7! Cape Flats, *Ecklon*!; *Zeyher*, 1742, ♂!

A species apparently nearly allied to *R. triticeus*, Rottb., but differing from it in the more branched inflorescence, in the smaller spikelets, in the presence of a spathe, in the different form and proportions of bracts, glumes, &c. The membranous edges of the sheaths and spathes give the plant a very ragged aspect—whence the name.

** *Culmi plerumque compressi v. angulati.*

R. TETRAGONUS, *Thunb. Prod.* p. 15; *Diss.* p. 17. n. 17; *Fl. Cap.* i. p. 87. n. 20; *Willd. Sp. Pl.* iv. 2. p. 725. n. 21; *Nees ab Esenb. Linnæa*, v. p. 642; *Kunth, En.* iii. p. 400; *Steudel, Synops.* ii. p. 253.

Var. β. EXALTATUS, *Nees, l. c.* Culmo alto folioso, panicula virgata, spiculis sessilibus pedunculatisque.

*Hab.* C. B. S. Ex. sp. s. ♂. *Masson*!; False Bay, *Robertson*!; *Eck.* 85! ♀. *Sieber, Fl. Cap.* 118!; ad pedem montis Diaboli altit. ii., inter frutices, *Eck.* (August); *R. C. Alexander*!—β. ♂, ad cataractas montis Diaboli (Junio), *Eck.*!; *Drège*, ♂, 364!; *Milne in herb. Hook.* 435!

A distinct and handsome species, varying in luxuriance according to the situation in which it grows. The female plant distributed under *Drège*, 364, belongs to a hitherto undescribed species, *R. bifurcus*, Nees, MS.

R. EGREGIUS, *Hochstetter, Flora,* (*B. Z.*) 1845, p. 337, *adnot.*; *Steudel, Synops.* ii. p. 253.

Var. β. NUTANS, *Mast. MS.* Culmis spiculisque minoribus, spiculis (masculis) nutantibus.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Zeyher.* ♂. Hottentotshollandberg, *Ecklon*!; *Dr. Thom in herb. Hook.* 632!, 906!—β. ♂ et ♀. *Zeyher*!; *Admiral Grey in herb. Hook.*!; Table Bay, *Robertson*!; False Bay, *Robertson*!

It is remarkable that so handsome-looking a species should

have been overlooked so long. The female plant has a much more simple inflorescence than the male, and much larger spikelets.

R. BIGEMINUS, *Nees, MS.* Ramis primariis compressis (crassitie pennæ corvinæ), parum dichotome ramulosis, ramulisque ascendentibus, elongatis, olivaceis, punctulatis, minutissime albo lepidotis, aphyllis; vaginis arctis, ovatis, coriaceis, sub apice obtuso membranaceo retuso herbaceo-cuspidatis, ad ramificationes squamam alteram oblongam bicarinatam amplectentibus; spiculis (femineis) in apice ramulorum 1–5 approximatis, in racemum erectum terminalem dispositis, singulis erectis, plurifloris, ovato-oblongis v. ellipticis (7–8 lin. long., 1–2 lin. lat.), sessilibus vel breviter pedicellatis, basique spatha aperta vaginæformi brevi præditis; bracteis laxiuscule imbricatis, oblongo-lanceolatis, coriaceis, ferrugineo-griseis, micantibus, prominenter septemnervosis, sub apice tenuiore mucronulatis, infimis vacuis, ceteris flores oblongo-acutos pedicellatos triplo superantibus; glumis externis rigidiusculis, oblongo-lanceolatis, æqualibus, pallide ferrugineis, lateralibus conduplicatis, carinatis, carina glabra; glumis internis conformibus, dimidio brevioribus, vix hyalinis, postica latiore; staminodiis 3, ligulæformibus; ovario rotundato, apice truncato, ferrugineo, biloculari; stigmatibus elongatis, villoso-plumosis; capsula rotundata, bi- vel abortu uniloculari, coriacea, ferruginea, ad margines dehiscente, stigmatum vestigiis coronata; seminibus magnis, oblongis, ferrugineis, testa subcoriacea tuberculis majusculis obsita.

R. bigeminus, *Nees, MS. in herb. Sonder.*—R. (Thamnochorti) micantis feminea, *Nees, MSS., sed vix.*

*Hab.* C. B. S. Ex. sp. s. ♀. Cape Flats (August), *Eck. et Zeyh.* 1123.

In Dr. Sonder's herbarium are two specimens, evidently of the same species: one has a label attached to it, with the name *R. bigeminus*, mihi (*i. e.* Nees); the other, which is precisely similar, has the name "*R. micans*, N. ab E. in Linnæa, v. p. 649," in the handwriting of that botanist; but as neither specimen accords well with the description of *R. micans* in the 'Linnæa,' I have preferred to adopt the name *R. bigeminus*.

R.? DISPAR, sp. n. Ramis primariis erectis (crassitie pennæ gallinaceæ), subcompressis, dichotome ramulosis, ramulis erectis, curvatis, olivaceis, albo tuberculatis; vaginis semipollicaribus, arctis, ellipticis, acutis, coriaceis, fuscis, marginibus superne hyalino-membranaceis, destructis; spiculis 4–6, in spicam disticham flexuosam approximatis, singulis oblongis, acutis, erectis (5–6 lin. long.), spatha magna aperta vaginæformi suffultis; bracteis arcte imbricatis, omnibus fertilibus, singulis oblongis, convexis, vix carinatis, rigidis, purpurascentibus, flores oblongos duplo superantibus; glumis externis inæqualibus, oblongis, obtusis, rigidis, lateralibus conduplicatis, villoso-carinatis;

glumis internis inter se æqualibus, externis paulo brevioribus, oblongis, acutis, hyalinis, basi incrassatis; antheris oblongis, apiculatis, purpurascentibus; pistilli rudimento minuto. Femina latet.

*Hab.* C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 52. 8.

One of the outer lateral glumes in this species exceeds its fellow in size, and partially overlaps it.

R. BIFURCUS, *Nees, MSS.* Culmis erectis, bipedalibus, simplicibus vel parum dichotomeque ramosis, ramisque compressiusculis, olivaceis, squamis orbicularibus albidis obsitis; vaginis arctis, semipollicaribus, tubulosis, coriaceis, striatis, fuscis, sub apice obtuso membranaceo cuspidatis, basi annulo impresso notatis, ad ramificationes nonnunquam squamam alteram oblongam dorso bicarinatam villosam amplectentibus: spiculis masculis pluribus, in paniculam erectam cymosam elongatam magis minusve ramosam dispositis, singulis plurifloris, erectis, ovatis, sessilibus vel breviter pedicellatis (3–5 lin. long., 1–2 lin. lat.), basi spatha vaginæformi suffultis; bracteis arcte imbricatis, oblongis, coriaceis, castaneis, dorso superne impresso-punctulatis, sub apice obtusiusculo cuspidatis, infimis 2–3 vacuis, ceteris fertilibus, flores masculos oblongos stipitulatos vix æquantibus; glumis externis oblongis, obtusis, rigidiusculis, dorso medio villosis, lateralibus naviculari-conduplicatis; glumis internis parum brevioribus, oblongo-lanceolatis, hyalinis, ima basi connatis, nonnunquam incrassatis; filamentis complanatis, albidis, intra discum parvum membranaceum lobatum orientibus; antheris lineari-oblongis, dorso ferrugineis, demum exsertis; pistilli rudimento trigono: spiculis femineis paucioribus, in paniculam minus ramosam dispositis, singulis oblongo-lanceolatis, demum subclavatis, paucifloris (4–5 lin. long., 1–2 lin. lat.); bracteis glumisque ut in mare; staminodiis 3, ligulæformibus, basi disco membranaceo parvo lobato cinctis; ovario trigono, nigro-castaneo, biloculari, stigmatibus longis villoso-plumosis superato; capsula biloculari, glumis persistentibus obtecta.

R. bifurcus, *Nees, MS. in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. Gnadenthal, *Eck. et Zeyh.* ♂ et ♀, n. 39! In planitie Capensi, *Eck.* n. 564*c*, ♂! Cape Flats, *Zeyher*, ♂ et ♀, 1011; *Drège*, nn. 46, 364, 1608, ♀!; *Dr. Thom in herb. Hook.* 49, ♂! Cape Town, *Harvey*, ♂!

Adsunt nonnunquam *culmi steriles* quam fertiles dimidio breviores, supra basin dichotome ramosi, ramique ramulosi, ramulis longiusculis, ascendentibus, compressis, olivaceis, albo lepidotis; *vaginæ* arctæ, coriaceæ, olivaceæ, sub apice obtuso membranaceo, nec hyalino, longissime foliaceo-mucronatæ.

Both male and female spikelets occasionally have a small leaf-bud in the place of a flower (lateral foliar prolification). The small membranous disk which is so constantly found in this spe-

cies between the inner series of glumes and the stamens or the staminodes is of interest, as it may possibly represent an outer series of stamens alternating with those usually present, which are *opposite* to the inner glumes. Should this view of the nature of the disk be correct, the normal symmetry of the flower would be restored.

R.? FESTUCÆFORMIS, *Nees, MS.* Culmis cæspitosis, erectis, subcompressis (sesquipedalibus, diametro pennæ corvinæ), simplicibus vel supra medium parum dichotome ramosis, ramisque ascendentibus, stramineis, impresso-punctulatis; vaginis pollicaribus, arctis, ellipticis, coriaceis, striatis, fuscis, marginibus superne membranaceis, sub apice obtusiusculo longe setaceis; spiculis pluribus, in cymam densam terminalem obovatam aggregatis, singulis erectis, plurifloris, cylindraceo-oblongis (8–10 lin. long., 1 lin. lat.); bracteis laxe imbricatis, lanceolatis, chartaceo-membranaceis, pallide fuscis, dorso nervo medio prominente notatis, infimis vacuis, ceteris flores stipitulatos longe superantibus, basi ita decurrentibus ut spiculæ rachis alata videtur; glumis externis oblongo-obtusis, subcoriaceis, cinereis, pubentibus, lateralibus conduplicatis, vix carinatis; glumis internis planiusculis, vix brevioribus, angustioribus (in flore masculo hyalinis, in flore femineo chartaceis); filamentis capillaribus; antheris oblongis, apiculatis, antice flavis, dorso ferrugineis; ovario parvo, oblongo vel subrotundo, biloculari, stigmatibus tribus villosis superato; capsula ——.

R. festucæformis, *Nees, MS. in herb. Sonder.*—R. ischæmoides, *Nees, MS.* (*olim*).

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 5!

In the absence of ripe fruit, there remains a doubt whether this very distinct-looking species belong really to this genus or not. So far as I have been able to ascertain, Nees has nowhere published the species under either of the names affixed to it in his handwriting in Dr. Sonder's herbarium. The female plant almost precisely corresponds with the male, *mutatis mutandis.* In the male plant the flowers are somewhat curved laterally, so that one of the outer lateral glumes becomes thereby much more conduplicate than the other.

R. SUBULATUS, *Mast. MS.* Culmis sterilibus decumbentibus, spithamæis, ramosissimis, ramulis subfasciculatis; vaginis tubulosis, arctis, coriaceis, brunneis, superne membranaceis, sub apice longe subulato-mucronatis: culmis fertilibus sesquipedalibus, simplicibus, compressis, olivaceis, impressis, albo tuberculatis; spiculis masculis femineisque conformibus, 6–8, in spicam linearem terminalem approximatis, singulis ovato-oblongis (3–4 lin. long., 3 lin. lat.); bracteis oblongis, coriaceis, sub apice mucronatis, laxe imbricatis, infimis sterilibus, ceteris flores

superantibus; glumis externis rigidiusculis, oblongo-acutis, lateralibus conduplicatis, villoso carinatis; glumis internis parum brevioribus, latioribus, hyalinis; antheris flavis, dorso castaneis; pistilli rudimento minuto; staminodiis 3; ovario ——; capsula ovata, compressa, biloculari, coriacea, ferruginea.

*Hab.* C. B. S. Ex. sp. s. ♀. *Eck. et Zeyh.* 51. 7!

R. PURPURASCENS, *Nees, MS.* (*absque descriptione*). Culmo erecto, valido, compressiusculo, bi–tripedali (crassitie pennæ anserinæ), versus medium dichotome ramoso, ramis longiusculis, erecto-patentibus; vaginis, nisi ad ramificationes, arctis, ellipticis, obtusis, fuscis, coriaceis, purpureo maculatis, marginibus superne membranaceis, sub apice obtuso foliaceo-mucronatis; spiculis 2–5, in apice ramorum spicatim dispositis, approximatis vel parum remotis, sessilibus vel pedicellatis, singulis oblongis, obtusis, erectis, pollicaribus (2–3 lin. lat.), basi spatha aperta vaginæformi præditis; bracteis laxe imbricatis, infimis vacuis, ceteris fertilibus, oblongis, acutis, coriaceis, ad margines membranaceis, flores 3–4plo superantibus; glumis externis rigidiusculis, oblongo-lanceolatis, lateralibus naviculari-conduplicatis, villoso-carinatis, intermedia basi incrassata, lateralibus vix longiore; glumis internis brevioribus, subhyalinis, conformibus, in plant. masc. imo basi connatis; antheris lineari-oblongis, apicatis, dorso ferrugineis, antice flavidis; pistilli rudimento trigono; ovario subtrigono, castaneo, biloculari, stigmatibus tribus linearibus villosis elongatis superato; capsula biloculari, ad margines dehiscente.

Variat culmo spiculisque minoribus.

R. purpurascens, *Nees, MS. in herb. Sonder.* Femina tantum.

*Hab.* C. B. S. Ex. sp. s. ♂. *Dr. Lind in herb. Mus. Brit.*! ♀. Hottentotshollandberg (Maio), *Eck. et Zeyh.* 59. 5!

This handsome species seems closely allied to *R. compressus*, Rottb., especially to the larger variety of that plant; but the culms and spikelets are not nearly so much compressed. In the present plant the whole surface is covered with purplish spots.

R. IMPOLITUS, *Kunth, En.* iii. p. 404; *Steud. Synops.* ii. p. 253.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, nn. 66, 67! Femina latet.

R. SPINULOSUS, *Kunth, En.* iii. p. 402. n. 32; *Steud. Synops.* ii. p. 253. n. 43.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 37!

R. COMPRESSUS, *Rottb. Descr. et Ic.* p. 6, t. 2. f. 2; *Willd. Sp. Pl.* iv. 2. p. 725. n. 19; *Spreng. Syst. Veg.* i. p. 185 (excl. syn. *R. cuspidati* Thunb. cui culmus teres); *Kunth, En.* iii. p. 403. n. 33; *Nees ab Esenb. Linnæa*, v. p. 642; *Steud. Synops.* ii. p. 253. n. 44.

Var. β. MAJOR, culmo robustiore, spiculis majoribus.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 5!; *Drège*, 33!—Var. β. Locis humidis in planitie Tabulari (April). ♂. *Eck.* n. 842!;

*Un. It.* 849 !; *Sieber,* 224 !; *Eck. et Zeyh.* 51. 8 ! Babyloonske-toorne (August), *Zeyh.* 4350 !; *Drège,* 48 !

R. FASTIGIATUS, *Nees, MS. in herb. Sonder.*—R. callistachyus, *Kunth, En.* iii. p. 400. n. 29; *Steud. Synops.* ii. p. 253. n. 40 (quoad plantam femineam).—R. polystachyus, *Kunth, En.* iii. p. 402. n. 31; *Steud. Synops.* ii. p. 253. n. 42 (quoad plantam masculam).—R. elongatus, *Thunb.* (♀) *teste Hochstetter, sed vix.*—R. digynus ♀, *Link, MS. in herb. Sonder.*—R. dubius ♂, *Klotsch in herb.*

*Hab.* C. B. S. Ex. sp. s. ♀. *Zeyher,* nn. 539, 4341 (Febr.) !; Winterhoeck, *Ecklon* !; Uitenhage, *Krauss* (April), *teste Hochstetter; Krebs teste Link*; *Drège,* n. 30 ! ♂. *Ecklon* !, *Zeyher* !, *Mundt* !; *Drège,* n. 32 !

I have ventured in this case to depart from the usual rule of adopting a manuscript rather than a published name, for the following reasons :—Nees, as I believe correctly, recognized the two forms as male and female respectively of the same species, and applied a very appropriate name, and one equally applicable to either sex. So far as I have been able to ascertain, Nees did not in any way publish the name. Later, when Kunth examined Drège's specimens for his 'Enumeratio,' he considered the male and female plants to constitute two distinct species, and named them accordingly, but neither of his names is so appropriate to either plant as Nees's.

### *** *Culmi filiformes.*

R. VAGINATUS, *Thunb. Prod.* p. 15; *Diss.* p. 10. n. 2; *Fl. Cap.* i. p. 83. n. 2; *Willd. Sp. Pl.* iv. 2. p. 719. n. 4; *Spreng. Syst. Veg.* i. p. 184. n. 3; *Kunth, Enum.* iii. p. 408. n. 42; *Hochstetter, Flora, (B. Z.)* 1845, p. 337.—R. pseudoleptocarpus, *Kunth, En.* iii. p. 399; *Steud. Synops.* ii. p. 252. n. 39.

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Sieber, Herb. Cap.* 221; *Flora Mixta,* 22 ! In summitate montis Tabularis (Jan.-April.), *Eck.* ! Uitenhage, *Zeyher,* ♀ !; *Ludwig,* ♂ ! Cape Town, *Harvey,* ♂ !; *Drège,* 28, ♂ ! Table Mountain (Maio), *Krauss.*

Hochstetter, I believe correctly, speaks of the above in these words: "*R. pseudoleptocarpus* Kunth. ipsissimus *R. vaginatus* Thunb. esse videtur, quem inter dubias, a se non visas, cl. Kunthius enumerat."

R. DEBILIS, *Nees ab Esenb. Linnæa,* v. p. 640; *Kunth, En.* iii. p. 412. n. 50; *Steud. Synops.* ii. p. 254.—Thamnochortus debilis, *Zeyh. teste Kunth.*

*Hab.* C. B. S. Ex. sp. s. ♂. *Zeyher,* n. 33 (Martio, Aprili) !

Plantæ cujusdam femineæ, in herb. Sonderiano, a me examinatæ, huic speciei forsan referendæ, notas adjicio :—

*Culmus* 2–3-pedalis, erectus, teres v. subcompressus, crassitie pennæ corvinæ, versus medium dichotome ramosus, ramique ascendentes, elongati, olivacei, tuberculis albidis parvis obsiti, iterum subfasciculatim ramulosi, ramulis ultimis diffusis, filiformibus, rigidiusculis (aphyllis?). *Vaginæ*, nisi ad ramificationes, arctæ, ellipticæ, striatæ, marginibus superne membranaceis, sub apice obtusiusculo setaceo aristatæ. *Spiculæ* in apice ramulorum solitariæ, ovato-oblongæ, 1–2 lin. long., vix 1 lin. lat., pluriflore. *Bracteæ* laxe patentes, oblongæ, coriaceæ, ferrugineæ, sub apice membranaceo acute mucronatæ, flores oblongos vix superantes. *Glumæ externæ* 3, æquales, oblongæ, rigidiusculæ, pallide ferrugineæ, laterales duæ conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3, externas longitudine æquantes, latitudine autem eas superantes, oblongæ, spathulatæ, chartaceæ, pallide ferrugineæ. *Staminodia* nulla? *Ovarium* ut videtur oblongum, subtrigonum, stigmatibus linearibus villosis tribus superatum.

The specimen examined was too imperfect to allow of the structure of the ovary being satisfactorily determined. Sprengel is stated by Nees (*l. c.*) to have referred this plant to the genus *Thamnochortus*.

R. MISER, *Kunth, En.* iii. p. 392. n. 19; *Steud. Synops.* ii. p. 252.
*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 1627!

Kunth has erroneously placed this species in the two-styled section. The female flowers have staminodia and a trigonous two-celled ovary surmounted by three styles.

R. SUBTILIS, *Nees, MS.* Culmis sterilibus erectis, subcompressis, filiformibus (sesquipedalibus), sulcatis, parce dichotome ramosis, ramisque tenuissimis, erectis, longissimis, remote vaginatis, stramineis: culmis fertilibus consimilibus, longioribus, supra medium ramosis; vaginis arctis, tubulosis, unguicularibus, coriaceis, sulcatis, marginibus superne vix membranaceis, sub apice obtusiusculo foliaceo-mucronatis; spiculis remotis, in paniculam laxam cymosam elongatam dispositis, sessilibus v. longiuscule pedicellatis, singulis ovatis, acutis, bifloris (vix 1 lin. longis, $\frac{1}{2}$ lin. lat.); bracteis arcte imbricatis, late ovatis, coriaceis, fuscis, marginibus superne membranaceis, apice vix acuminato-mucronatis; floribus (masculis) ovatis, subcompressis, bracteis stipantibus, vix brevioribus; glumis externis ovato-oblongis, rigidiusculis, pallide fuscis, lateralibus conduplicatis, vix carinatis; glumis internis æqualibus, conformibus, vix brevioribus, hyalinis; antheris linearibus, flavis; pistilli rudimento minuto, trigono: spiculis femineis ut in mare, nisi numero paucioribus magnitudineque parum majoribus; staminodiis ligulæformibus; capsula trigona, triloculari (trisperma?), angulis salientibus dehiscente, superne stylorum vestigiis coronata, purpurea.

R. subtilis, *Nees ab E. in herb. Sonder.*
*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 6.

R. **Sonderianus**, sp. n. Culmis cæspitosis, spithamæis, filiformibus, erectis, flexuosis, simplicibus, rigidis, flavidis, minutissime punctulatis, basi spatium pollicare vaginis coriaceis castaneis impresso-punctulatis striatis dense obsitis, superne remote vaginatis; vaginis arctis, ellipticis, coriaceis, fuscis, nervoso-striatis, sub apice membranaceo cinereo subulato-mucronatis; spiculis 1–4, in apice culmi approximatis, sessilibus vel breviter pedicellatis, singulis ovato-oblongis, erectis (3–4 lin. long., vix 2 lin. lat.), basi spatha aperta vaginæformi suffultis; bracteis primum arcte demum laxe imbricatis, infimis sterilibus, oblongo-obtusis, coriaceis, nervoso-striatis, mucronato-aristatis, ceteris fertilibus, oblongis, acuminatis, castaneis, flores oblongos arcuatos vix superantibus; glumis externis oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas glabris; glumis internis parum minoribus, conformibus, hyalinis, basi ferrugineis; antheris lineari-oblongis, flavidis, exsertis; pistilli styli rudimento minuto.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 82 pro parte!

Kunth cites under *Drège* 82 his *R. pseudoleptocarpus* = *R. vaginatus*, Thunb., from which, however, the present differs considerably in size, in the warting of the culms, and in the form of the spikelets and glumes. It more nearly resembles the following species (*R. pedicellatus*, Mast.), also distributed with *Drège* 82, but is distinguished by the sheaths and especially by the bracts.

R. **pedicellatus**, sp. n. Culmis pedalibus, cæspitosis, erectis, filiformibus, teretibus, rigidis, simplicibus, flavidis, tuberculis obsitis, basi spatium pollicare vaginis ellipticis coriaceis castaneis striatis impresso-punctulatis sub apice retuso pallidiore subulato-mucronatis (mucrone sæpissime in folium elongatum lineare producto) obtectis; vaginis culmeis remotis, arctis, semipollicaribus, fuscis, striatis, sub apice emarginato membranaceo plerumque foliaceo-mucronatis; spiculis in apice culmi solitariis vel binis, erectis, juvenilibus cylindraceo-lanceolatis, demum oblongis, plurifloris (3–4 lin. long., 1–2 lin. lat.); bracteis primum arcte demum laxe imbricatis, oblongo-acutis, coriaceis, castaneis, sub apice obtuse mucronulatis, flores oblongos pedicellatos superantibus; glumis externis rigidiusculis, oblongo-obtusis, lateralibus conduplicatis, ad carinas glabris; glumis internis parum brevioribus, hyalinis; filamentis linearibus, albidis; antheris linearibus, flavidis, exsertis; pistilli rudimento minuto; staminodiis ligulæformibus; ovario trigono, abortu biloculari, castaneo, angulis salientibus viridescente, stigmatibus tribus coronato; capsula rotundata, biloculari, dehiscente, stigmatum vestigiis superata.

*Hab.* C. B. S. Ex. sp. s. ♂. *Drège*, 1629!; ♀. nn. 82! (pro parte), 91!

This differs from *R. Sonderianus* especially in the oblong obtuse glumes, which are provided with a very short "mucro;" the spikelets are also somewhat longer and of a more oblong shape than in the species just mentioned.

R. Harveii, sp. n. Rhizomate repenti, culmos plures teretes ascendentes squamis laceratis approximatis obtectos emittente: ramis sterilibus 2–4-pollicaribus, basi decumbentibus, teretibus, subspongiosis, infra medium dichotome ramulosis, ramisque curvatis, subcompressis, patentibus, sordide olivaceis, tuberculis albis parvis dense obsitis; vaginis arctis, ovatis, acutis, marginibus membranaceis, sub apice obtuso subulato-mucronatis: ramis fertilibus conformibus, duplo longioribus; spiculis in apice ramulorum solitariis, oblongo-cuneatis, bifloris (1 lin. long., vix 1 lin. lat.); bracteis laxe imbricatis, ovatis, acutis, convexis, marginibus superne membranaceis, sub apice acuto subulato-mucronatis, infimis 2 vacuis, ceteris fertilibus flores oblongos vix duplo superantibus; glumis externis æqualibus, oblongis, obtusis, chartaceis, marginibus ciliolatis, lateralibus conduplicatis, ad carinas ciliolatis; glumis internis conformibus, vix brevioribus, dorso medio subcarinatis, ciliolatis; staminodiis 3; ovario oblongo, subcompresso, biloculari, stigmatibus 3 villosis superato; fructu ——.

*Hab.* C. B. S. Ex. sp. s. ♀. Cape Town, *W. H. Harvey in herb. Coll. S. Trin. Dubl.*!

The comparatively long trailing rhizome of this plant, like that of *Carex arenaria*, gives it a distinct aspect from the other species. Its spongy texture is also remarkable. In the form of its spikelets it much resembles *R. tenuissimus*, Kunth, but the structure of the spikelets and flowers is very different (see Pl. XV. figs. 1–7).

R. perplexus, *Kunth, En.* iii. p. 406. n. 38; *Steudel, Synops.* ii. p. 253. n. 51.—R. dichotomus, *Willd. herb.* (nec *Thunb.*) *teste Kunth.*

*Hab.* C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 339*a*! ♂. *Breutel*!; *Drège*, n. 8!

R. bifidus, *Thunb. Fl. Cap.* i. p. 87; *Nees ab Esenb. Linnæa*, v. p. 636; *Kunth, En.* iii. p. 409; *Steud. Synops.* ii. p. 250.—R. filiformis, *Poir. Enc. M. V.* p. 173?—R. monostachyus, *Steud. in herb.*—Variat spicis 1–4.

β. "Culmo flexuoso mono- vel distachyo, vaginis in mucronem longum trigono-subulatum foliaceum patulum exeuntibus."—*Nees, l. c.*

R. oligostachyus, *Kunth, En.* iii. p. 399. n. 27; *Steud. Synops.* ii. p. 252. n. 38.—R. bifidus, *N. ab E., forma gracilis in herb. Sonder.*

*Hab.* C. B. S. Ex. sp. s. *Thunberg in herb. Sonder.*!; *Eck. Un. It.* nn. 840, 846, ♂, forma depauperata=R. monostachyus, *Steud.*!; *Eck. et Zeyh.* 56. 5, ♂! Table Mountain, *Ecklon*, 77, ♂ et ♀!; *Breutel*, ♀!; *Zeyher*, 4343, ♂ et ♀!; *Drège*, 197!, 84 ♀, 1628 *b*! Simon's Town, *C. Wright in herb. Coll. S. Trin. Dubl.*, sub nn. 485, 497 ♂! (Aug.)—β. False Bay, *Robertson in herb. Mus. Brit.* ♀! Table Mountain, *Eck. et Zeyh.* ♀, 1. 11!, 1. 12!; *Drège*, nn. 37!, 1624 ♀! Simon's Town, *Wright*!

This species varies considerably in stature, number of spikelets, &c.; moreover the aspect of the immature spikelets is often considerably different from that pertaining to their fully developed condition. The bluntish, white-edged scales are useful guides in the discrimination of this species. The variety $\beta$ is subject to the same diversities of size, &c., as the species. Kunth has given the name *R. oligostachyus* to a form with elongated flexuose culms and large solitary spikelets. Steudel (in herb. Fielding.) gave the name *R. monostachyus* to a starved form of the species with slender, slightly flexuose culms and small spikelets. Some of the forms much resemble *R. Garnottianus*, but in that species the spikelets are more numerous, and the bracts are more acutely pointed, while their membranous edge is not so well marked, and their mucros are less abrupt than those of *R. bifidus*.

R. GARNOTTIANUS, *Kunth, En.* iii. p. 392. n. 18; *Steud. Synops.* ii. p. 251.

*Hab.* C. B. S. Ex. sp. s. ♂. *Ecklon*!; *Drège*, nn. 59!, 1628 *a*! et 2473! ♀. *Ecklon*!, *Zeyher*!

Plantæ femineæ adhuc indescriptæ characteres adjicio. *Culmus, vaginæ spiculæ*que ut in mare. *Flores* oblongi, sessiles. *Glumæ externæ* rigidiusculæ, oblongo-acutæ, laterales naviculari-conduplicatæ, villoso carinatæ, intermedia antica subconvexa dorso medio nervo ferrugineo notata; *glumæ internæ* conformes, parum minores, hyalinæ. *Staminodia* 3, albida. *Ovarium* trigonum, castaneum, biloculare, stylis 3 villosis superatum. *Capsula* lenticularis, trilocularis, dehiscens, glumis persistentibus obtecta.

In Dr. Sonder's herbarium some specimens of this plant are labelled as *R. dichotomus* by Nees. It is closely allied to *R. bifidus*, and may, indeed, be merely a form of that variable species.

### *Species mihi non satis notæ, plerumque forsan sub aliis nominibus recensitæ.*

R. elongatus, *Thunb. Fl. Cap.* i. 83; *Kunth, En.* iii. p. 408. n. 43.

R. concolor, *Steud. Synops.* ii. p. 251; *Drège*, n. 31.

R. pauciflorus, *Poir. Enc. Méth.* vi. 168; *Kunth, En.* iii. p. 412. n. 49.

R. fruticosus, *Thunb. Diss.* p. 16. n. 14; *Kunth, En.* iii. p. 413. n. 54 (an hujus generis?).

R. glomeratus, *Thunb. Diss.* p. 18. n. 19; *Fl. Cap.* i. 88; *Kunth, En.* iii. p. 414.

R. simplex, *Thunb. Diss.* p. 16. n. 15; *Kunth, En.* iii. p. 414.

R. lucens, *Poir. Enc. Méth.* vi. 169; *Kunth, En.* iii. p. 414.

R. vimineus, *Rottb. Descr. et Ic.* iv. t. 2. f. 1.

### *Species excludendæ.*

R. aristatus, *Thunb.* = Hypodiscus aristatus, *Nees.*
R. alboaristatus, *Nees* = Hypodiscus alboaristatus, *Nees.*
R. synchroolepis, *Steud.* = Hypodiscus synchroolepis.
R. echinatus, *Kunth* = R. squarrosus, *Lam.*
R. simplex, *Thunb.* = Staberohæ sp.
R. fuirenoides, *Kunth* = R. setiger, *Mast.*
R. Lucæanus, *Kunth* = R. Sprengelii, *Mast.*
R. tetrasepalus, *Steud.* = Staberohæ sp.
R. sulcatus, *Kunth* = Lepidanthus Willdenowia, *Nees.*
R. dichotomus, *Linn. Syst. Nat.* ed. 12. p. 735 = Thamnochortus fruticosus, *Berg. Fl. Cap. teste ipso Linnæi MS. in bibliotheca Linnæana.*
R. callistachyus, *Kunth* = R. fastigiatus, *Nees.*
R. polystachyus, *Kunth* = R. fastigiatus, *Nees.*
R. pseudoleptocarpus, *Kunth* = R. vaginatus, *Thunb.*
R. oligostachyus, *Kunth* = R. bifidus, *Thunb.*
R. obtusissimus, *Steud.* = R. digitatus, *Thunb.*
R. xyridioides, *Kunth* = R. quinquefarius, *Nees.*
R. dichotomus, *Rottb.* = Thamnochortus dichotomus, *Brown.*
R. acuminatus, *Thunb.* = Cucullifera dura, *Nees.*

## EXPLANATION OF THE PLATES.

### PLATE XIV.

*R. ferruginosus*, Link.

Fig. 1. Vertical section of old culm, showing the thick epidermal cells and two of the funnel-like cavities resulting from the breaking down of the resin-containing cells. The epidermal cells overlie a thick spongy layer of cellular tissue, &c. (see p. 222).

Fig. 2. Transverse section of old culm, showing the same tissues as in fig. 1.

Fig. 3. Vertical section of young culm to show the epidermal cells, and the cellular layer beneath.

Fig. 4. Transverse section of cortical tissues from culm rather older than in fig. 3. The subepidermal cells still retain their chlorophyll, but are beginning to assume the lengthened form and spongy texture characteristic of the old culm.

(All the figures magnified to about 200 diameters.)

### PLATE XV.

*R. Harveii*, Mast. (see p. 253).

Fig. 1. Plant, nat. size.

Fig. 2. Spikelet, magnified.

Fig. 3. Bract.

Fig. 4. Unexpanded flower.

Fig. 5. Outer lateral glume (conduplicate), anterior glume, and one of the inner glumes.

Fig. 6. Ovary and staminodia.

Fig. 7. Culm-sheath.

# Observations on some Orchids of the South of France. By JOHN TREHERNE MOGGRIDGE, Esq. Communicated by the President.

[Read Nov. 3, 1864.]

[PLATE XVI.]

DURING the past winter and spring spent in the South, I had some opportunities of observing the Orchidaceæ of those parts, and noting down what seemed to me strange and new about them. The 'Fertilization of Orchids,' by Charles Darwin, Esq., was of course the base upon which I worked, and which thus opened out for me a fresh and most delightful source of occupation.

*Orchis longibracteata*, Bivona (*Aceras longibracteata*, Grenier and Godron), is the first orchid which comes into flower; and as it commences blossoming on or before New Year's day, a long period is allowed over which to extend one's investigation. I propose, therefore, to show first how that plant is adapted for fertilization, and what insect is an agent in the matter. The caudicles of the pollinia are united on to one common gland (as in *Orchis pyramidalis*), and placed in a pouch, which stands higher with reference to the surface of the labellum than in any Orchis I have examined. This elevation admits of the interference of a larger and stronger insect—of just such a one, in fact, as *Xylocopa violacea*, a specimen of which I had the good fortune to see taken, bearing the pollinia of this species fastened on its forehead. By reference to Pl. XVI. fig. 1*a*, the relative positions of the large pear-shaped stigmatic cavity of the pouch, and the labellum will be seen. In the dissection of this (*b*) the greater part of the labellum has been removed, leaving one of the small guiding-plates on the further side. When first taken the pollinia are widely separated and upright (*c*); but by convergence the masses are soon drawn together (*d*), and then prostrated (*e*). The motion in either plane is, in unmutilated specimens, distinct, the prostration always setting in after convergence. For comparison, I have drawn (fig. 3) a similar view of *Orchis hircina*, with a foreign specimen of which I have been favoured since my return to England. *Orchis hircina* has the pouch very low in the flower; and the structure will be seen to vary in several other details. Its pollinia, judging from those furnished by that spike alone, accomplish their convergence during their prostration, and not by separate motions.

I have myself seen *Orchis longibracteata* visited by several species of Hymenopterous and Dipterous insects; and I feel sure that many of the more minute Ephemeræ are attracted by this and some other Orchidaceæ, as a small spider of a colour wonderfully matched to the flowers or bracts constantly spins his web round the spike, the threads passing in front of the stigmatic chamber. On one occasion I had a close view of a Dipterous insect at work on the labellum of a flower of *Orchis longibracteata*; the plant, being in a pot on a balcony, was raised to the level of my eye. I saw that the proboscis was dipped into each of the open cells of honeycomb texture, and instantly withdrawn; but, judging from the lengthy stay of the insect on the flower, it found in these tiny glistening cavities some liquid worth its search. Being anxious to ascertain whether the spikes were more attractive to the agents of fertilization at any definite stage of the blossoming, I made the following notes. I must premise that, by the average number of blossoms, those on any one spike may be taken as about 30, but they range from 15 to 50.

| Date of gathering. | | Number of expanded flowers. | Number of stigmas touched. | Number of pairs of pollinia taken. |
|---|---|---|---|---|
| March 1. | Spike No. I. ......... | 18 | 4 | 0 |
| | „ „ II. ...... | 7 | 2 | 0 |
| | „ „ III. ...... | 11 | 1 | 0 |
| „ 7 | Spike No. I. ......... | 12 | 1 | 4 |
| | „ „ II. ...... | 10 | 5 | 0 |
| | „ „ III. ...... | 5 | 3 | 2 |
| | „ „ IV. ...... | 10 | 0 | 0 |
| | „ „ V......... | 16 | 2 | 0 |
| | „ „ VI. ...... | 8 | 1 | 0 |
| | „ „ VII....... | 11 | 3 | 3 |
| | „ „ VIII. ... | 12 | 2 | 3 |
| „ 8. | Spike No. I. ......... | 10 | 1 | 3 |
| | „ „ II. ...... | 23 | 4 | 5 |
| | „ „ III. ...... | 34 | 7 | 7 |
| | „ „ IV. ...... | 36 | 10 | 9 |
| | „ „ V......... | 24 | 0 | 0 |
| „ 10. | Spike No. I. ......... | 46 | 13 | 22 |

A plant of this Orchis placed by me in the shade had no pollinia removed or stigmas fertilized; and I notice that this is frequently the case in places where the sun does not strike. When I found that the blossoms on this spike were beginning to fade (which was not till the 59th day after the expansion of the first flower), I remarked that all the stigmatic tissue was quite dried up, with the exception of part of the surface of one quite at the top. I then touched the pouch of the flower 59 days old, and the gland immediately adhered; and though the caudicles were weak, the movements were effected in about 3 minutes. The pollinia of succeeding flowers became gradually more and more efficient, and fertilized a fresh spike in the ordinary way. This shows that the pollinia may be removeable and useful after the spike on which they are is incapable of fertilization.

Fig. 2 represents a spike of *Serapias cordigera* (Linn.), a plant which has two pollinia united on one gland, as in the preceding, but possesses a complex and most interesting fertilization. On their withdrawal the masses are bent back away from the stigma (*b*), but quickly reverse and accomplish their depression and contraction as in *Orchis hircina*. The stigmatic cavity is exceedingly narrow and obscure; so that, though the column is enclosed in a somewhat tubular chamber formed by the upright anterior lobes of the labellum and the hood-shaped coherent segments of the flower, the pollen-masses on an insect's head would be very apt to miss coming in contact with its viscid surface at all. To remedy this, the guiding-plates (*a*, fig. 2) are raised into a two-walled glabrous trough, in which the masses slide without fail against the stigma. I secured a specimen of an insect (*Ceratina albilabris*) in the act of touching the stigma of this plant with the yellow pollen of *Serapias lingua*, two pairs of pollinia of which were fastened on its head; the gland of one pair partially covered the right eye.

In the case of *Xylocopa violacea* and *Ceratina albilabris*, therefore, we find the glands attached to their heads, not their proboscides; and it seems probable, as the height at which the pouch stands is most accurately in relation to that of the insect fertilizer, and as the flat glands are not easily removed by any narrow object or slight degree of pressure, that the elevation of the pouch is a feature of very great importance to the plants. My last observation concerns *Ophrys Scolopax* (Cavanilles), a plant very analogous to *O. Arachnites*. This plant appears under two forms in the two localities where I have obtained specimens. At Mentone I never saw any tendency to self-fertilization, but all the spikes of a large bundle sent me at Cannes were so without exception. This material difference between the two is accomplished by a very slight bend in the anther-cells, which are prolonged into a beak of variable length, in the case of the self-fertilizing blossoms. It is a remarkable coincidence, that at Mentone the Bee Ophrys is scarce, and at Cannes very abundant. So, within thirty miles of one another, we have one spot where self-fertilization is in full action, and another where it is, as far as I am aware, unknown.

# On the Genera *Sweetia*, Sprengel, and *Glycine*, Linn., simultaneously published under the name of *Leptolobium*. By GEORGE BENTHAM, P.L.S.

[Read November 3, 1864.]

THE late Dr. Vogel, when working up Sello's Brazilian Cæsalpinieæ at Berlin in 1836–7, published in the 11th volume of the 'Linnæa,' under the name of *Leptolobium*, a genus which seemed to form the connecting link between Papilionaceæ and Cæsalpinieæ; for, among several species which were evidently inseparable as to genus, some had curvembryous and others rectembryous seeds, and there were likewise irregularities in the æstivation of the petals. During the same winter, and before Dr. Vogel's paper was published, I was occupied at Vienna with a general arrangement of Papilionaceæ, and described under the same name of *Leptolobium* an Australian genus of Phaseoleæ, for some species which had been erroneously referred to *Kennedya*, and which did not then appear to me to be reducible to any other previously described one. My paper was only printed after I had left Vienna, and in the meantime Vogel's appeared. Acknowledging therefore the right of priority of his *Leptolobium*, I changed the name of mine to *Leptocyamus*. It now turns out that neither of our genera are tenable, although neither he nor I could be aware of it in the then state of the materials at our disposal. Although the two genera to which they must be reduced have little else in common than the fortuitous circumstance of having been simultaneously described under the same name, I trust that that may be sufficient excuse for comprising their history in the same paper.

And first as to Vogel's genus. That careful observer found amongst Sello's specimens some very indifferent ones of Sprengel's *Sweetia fruticosa*, which, as afterwards admitted by Sprengel himself, had been erroneously described, and was believed by both botanists to be identical with *Acosmium lentiscifolium* of Schott. Vogel accordingly described it under that name in his above-mentioned paper, adverting to its close affinity to *Leptolobium*, but retaining it as distinct on account of some difference in habit, and the calyx shortly toothed only, not lobed, the pod being then unknown. Authentic specimens of both Sprengel's and Schott's plants now show that *Acosmium* is indeed a congener of *Sweetia*, but not quite identical, the flowers being longer, somewhat differently shaped, and the calyx-teeth much deeper, intermediate in this respect between Sprengel's plant and *Leptolobium*. As the pod moreover proves to be quite that of *Leptolobium*, it follows that the whole must be united under one genus. Of the three names, Sprengel's has by many years the priority: the only objections to its adoption would be, first, that, owing to misdescription, it was not recognizable; and secondly, that a *Sweetia* was published by DeCandolle about the same time in the second volume of the 'Prodromus.' To the first objection it may be replied that, on the first occasion that the plant was met with and described, it was recognized by Vogel by means of authentic specimens; and to the second, that DeCandolle's *Sweetia* has been suppressed, having been ascertained to be no other than the common *Galactia tenuiflora*, W. & Arn. We are thus compelled to lay aside both Schott's and Vogel's names, and adopt Sprengel's dedication of the genus to our late laborious horticultural illustrator.

The genus, notwithstanding the anomalies which he did not fail to perceive, was placed by Vogel in Cæsalpinieæ; and in the rough sketch I made in 1840 (Hook. Journ. Bot. ii. p. 72) of an arrangement of that suborder I left it there, without having occasion to examine it in detail. It was thus omitted in the monograph of Brazilian Papilionaceæ which I published in Martius's 'Flora Brasiliensis.' But having now, in working up the order for our 'Genera Plantarum,' dissected several flowers of all the species we possess, I find that there is no doubt of its much closer affinity with the tribe Sophoreæ of Papilionaceæ. The æstivation of the petals, the main point of distinction between the two suborders, is essentially papilionaceous—the upper petal (vexillum) outside, then the two lateral ones, and the two lower inside: the exceptions, which I had formerly thought frequent in the genus, I find to be very rare, and only amount to this, that the vexillum is occasionally overlapped on one side by one of the wings; the two lowest or carinal petals I always find innermost. The other important character, the embryo, has in some species the straight radicle of Cæsalpinieæ, but in others it is curved or inflexed as in Papilionaceæ, a diversity which is not unfrequent in Sophoreæ—*Sophora* itself, for instance, having both straight and curved embryos, whilst the incurved radicle has as yet never been observed in true Cæsalpinieæ*. In other characters the habit resembles that of *Sclerolobium* and other Cæsalpinieæ, but is not unlike that of *Diplotropis* and others in Sophoreæ; the calyx, as in Sophoreæ, has the sepals united in a tube above the disk, which, although occasional, is very rare in Cæsalpinieæ; and the nearly regular corolla, which at first sight is characteristic of Cæsalpinieæ, occurs also in *Barklya*, *Cadia*, and several other Sophoreæ; the flat coriaceous indehiscent pod with thin edges occurs in Dalbergieæ and Sophoreæ, as well as in Cæsalpinieæ.

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* Swartzieæ, which have an incurved radicle, must be removed to Papilionaceæ.

I have now only to subjoin short diagnoses of the several species contained in the Kew herbaria.

## SWEETIA, *Sprengel.*

CHAR. GEN.—*Calycis* turbinato-campanulati dentes vel lobi valvati aut vix imbricati. *Petala* 5, subsimilia, erecto-patentia, imbricata, summo exteriore. *Stamina* 10, libera, parum inæqualia, exserta; *antheræ* uniformes. *Ovarium* sessile vel breviter stipitatum, 2–4-ovulatum; *stylus* filiformis, stigmate parvo vel truncato terminali. *Legumen* plano-compressum, coriaceum vel membranaceum, indehiscens. *Semina* plano-compressa, exalbuminosa; radicula nunc brevis et recta nunc longior et incurva vel inflexa.—Arbores. *Folia* pinnata, foliolis coriaceis; stipulæ parvæ vel inconspicuæ. *Flores* parvuli, racemosi, racemis ad apices ramorum paniculatis. *Bracteæ* et *bracteolæ* angustæ vel minutæ, sæpius caducissimæ.

Sect. I. *Acosmium.* Calycis dentes seu lobi tubo breviores. Embryonis radicula incurva v. inflexa.

1. S. FRUTICOSA, *Spreng. Syst.* ii. 213. Foliolis (multijugis?) parvis oblongis nitidis venosis, racemis gracilibus puberulis, calyce brevissime dentato, petalis calyce duplo longioribus, vexillo latissimo.—Acosmium lentiscifolium, *Vog. in Linnæa*, xi. 395, non *Schott.*

*Hab.* Rio Janeiro, *Sello.*

The specimens are all in the same state as those seen by Vogel, in flower only, without leaves, except a few loose fragments, showing leaflets of 3 to 4 lines; the petals are much shorter and broader than in *S. lentiscifolia.*

2. S. LENTISCIFOLIA, *Spreng. Syst. Cur. Post.* 406. Foliolis multijugis oblongis nitidis venosis, racemis gracilibus pubescentibus, calycis dentibus tubo vix brevioribus, petalis calyce subtriplo longioribus, vexillo paulo latiore.—Acosmium lentiscifolium, *Schott, in Spreng. l. c.*—Foliola ½–1 poll. longa, basi oblique angustata. Petala longe unguiculata. Filamenta gracilia. Legumen tenue, glabrum, nunc pollicare 1-spermum, nunc 2-pollicare 2-spermum, inter semina valde contractum (ovulo tertio intermedio abortiente?). Semina plana, oblonga, sub apice lateraliter affixa; cotyledones oblongæ; radicula longiuscula basi inflexa, cæterum recta.

*Hab.* Province of Rio Janeiro, *Schott.*

Sect. II. *Mesitis*, Vog. Calycis lobi tubo longiores. Embryonis radicula incurva accumbens.

3. S. BIJUGA. Foliolis 4–8 ovali-oblongis reticulatis subtus glaucis,

racemis brevibus puberulis, legumine tenui glabro.—Leptolobium bijugum, *Vog. in Linnæa*, xi. 391.—Foliola 1–2-pollicaria, coriacea, nitida, impari sæpius deficiente. Flores magnitudine eorum *S. dasycarpæ*; petala calyce dimidio longiora, vexillo breviore et latiore.

*Hab.* Between Victoria and Bahia, *Sello*; Ilheos, *Lushnath, Mart. Herb. Fl. Bras.* n. 1322.

Sect. III. *Leptolobium.* Calycis lobi tubo æquales v. longiores. Embryonis radicula brevis, recta.—Foliola in omnibus excepta *S. Gardneri* obtusissima vel emarginata. Florum alabastra in 4 prioribus subpyriformia, in 3 ultimis magis globosa.

4. S. BRACHYSTACHYA, sp. n. Foliis glaberrimis, foliolis 5–9 parvis ovato-oblongis opacis subtus pallidis, racemis brevibus laxe subcorymbosis puberulis.—Foliola ½–¾-pollicaria, retusa. Flores fere *S. nitentis.* Petala parum inæqualia. Legumen ignotum.

*Hab.* Serra da Lapa, *Riedel.*

5. S. DASYCARPA. Foliis subtus vel utrinque velutino-pubescentibus, foliolis 3–7 ovatis rigidulis venosis, panicula ampla pubescente, calyce basi attenuato, legumine tenui pubescente.—Leptolobium dasycarpum, *Vog. in Linnæa*, xi. 388.—Foliola 1½–3-pollicaria.

*Hab.* Apparently common in a great part of Brazil from Minas Geraes to Para, *Gardner*, n. 2543 & 3116; *Blanchet*, n. 3114, and many other collectors.

*Leptolobium lanceolatum*, Tul. in Arch. Mus. Par. iv. 118, seems to be a slight variety of *S. dasycarpa.*

6. S. GLABRIFOLIA. Foliis glabris vel subtus parce puberulis, foliolis 3–5 ovatis rigidulis venosis, panicula ampla pubescente, calyce basi attenuato, legumine tenui glaberrimo.—Leptolobium glabrifolium, *Tul. in Arch. Mus. Par.* iv. 118; L. tortuosum, *Mart. Herb. Fl. Bras.* n. 1151; L. elegans var. grandiflorum, *pl. exs. ex herb. Berol. distributæ.*

*Hab.* Provinces of Minas Geraes and Piauhy.

Perhaps a variety of *S. dasycarpa.*

7. S. NITENS. Foliis glaberrimis, foliolis 7–9 ovatis vel elliptico-oblongis rigidulis nitidis vix venulosis, racemis densis puberulis, calycis lobis summis latissimis, legumine crassiusculo coriaceo glabro.—Leptolobium nitens, *Vog. in Linnæa*, xi. 394; L. nitidulum, *Miq. Stirp. Surin.* 18.—Foliola 1–3-pollicaria.

*Hab.* British Guiana, *Rob. Schomburgk*, 1st coll. n. 526, 2nd coll. n. 239 & 457; *Rich. Schomburgk*, n. 379 & 730. Surinam, *Hartmann*, n. 1126. Rio Negro and Santarem, *Spruce*, n. 921. Vasiva River, *Spruce*, n. 3310.

8. S. ELEGANS. Glaberrima, foliis 5–11 ovatis v. ovali-oblongis tenuiter coriaceis nitidis oblique venosissimis, racemis laxiusculis brevibus, legumine tenui glabro.—Leptolobium elegans, *Vog. in Linnæa*, xi. 390.—Foliola 1–2-pollicaria.

*Hab.* Provinces of Minas Geraes and S. Paolo, *Sello*, and others; *Mart. Herb. Fl. Bras.* n. 1150.

9. S. Panamensis, sp. n. Glabra vel tenuissime puberula, foliolis 5–11 ovatis vel ovali-oblongis rigidulis nitidis tenuiter venulosis, racemis laxiusculis puberulis, legumine tenui glabro.—Foliola 1–2-pollicaria.
*Hab.* Paraiso station, Panama railroad, *Sutton, Hayes.*

This species has the foliage nearly of *S. nitens*, with the fruit of *S. elegans*.

10. S. Gardneri, sp. n. Glaberrima, foliolis 3 ovatis vel elliptico-oblongis breviter acuminatis tenuiter coriaceis nitidis venosissimis, racemis laxis breviter paniculatis.—Foliola nunc 1½–2-pollicaria, nunc duplo fere majora. Racemi numerosi, panicula tamen foliis brevior. Alabastra ut in speciebus 2 præcedentibus fere globosa, calyce basi brevissime tantum attenuato. Petala inter se subæqualia. Legumen ignotum.
*Hab.* Prov. Pernambuco, *Gardner*, n. 962.

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*Leptolobium tenuifolium*, Vog. in Linnæa, xi. 391, which I have not seen, appears to me to be very doubtful. It is described as differing from the others in its membranous leaves and broader petals. It was gathered by Sello between Campos and Victoria.

*Leptolobium? leiocarpum*, Vog. in Linnæa, xi. 393, described from fruiting specimens only, and therefore left doubtful, proves to be the fruiting state of *Apuleia præcox*, Mart.

*Leptolobium? punctatum*, Benth. in Linnæa, xxii. 526, described from indifferent specimens in flower only, is *Myrocarpus frondosus*, Allem., a distinct genus, but of which the position in the system, either next *Sweetia* in Sophoreæ, or as an anomalous Cæsalpiniea, is as yet doubtful. The flowers are too fully out to ascertain the æstivation, especially as the petals are exceedingly narrow linear.

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The genus *Leptolobium* or *Leptocyamus*, which I had proposed, is reducible to *Glycine*, Linn., as now most conveniently limited. Up to the time of DeCandolle's 'Prodromus,' the genera *Glycine* and *Dolichos* had become receptacles for all Phaseoleæ which had no very striking character to distinguish them. DeCandolle, in reforming the order, eliminated most of the anomalous species which had been referred to *Glycine* for want of a better place, and established a somewhat better-characterized group of small-flowered slender Phaseoleæ, distinguished from *Galactia* chiefly by the calyx. He still retained, however, two distinct types, afterwards well separated by Arnott (in Wight and Arn. Fl. Penins. Ind. Or.)—one with the alternate stamens abortive and a remarkably hooked pod, the other with the stamens all perfect and the pod straight or slightly incurved at the end—the one represented by *G. labialis*, Linn. f., the other by *G. javanica*, Linn. Not being aware that either group had been previously published as a genus, Arnott retained the name of *Glycine* for the former, as containing the commonest and most widely spread species, and gave to the latter the new name of *Notonia*, which he afterwards changed to *Johnia* on perceiving that DeCandolle had already published a *Notonia* in Compositæ. This nomenclature was unfortunate; for recent investigations have shown that *Glycine* so limited not only excluded all the species of the elder Linnæus, but was identical with *Teramnus*, Swartz, adopted in the 'Prodromus,' and that *Johnia*, on the other hand, comprising *G. javanica*, Linn., which had never yet been generically separated, had much more legitimate grounds for retaining the Linnean name. It is true that *G. Soja*, Sieb. & Zucc. (*Dolichos Soja*, Linn.), which I now propose to restore to the same group, had been adopted as a genus by DeCandolle after Mœnch; but even supposing the union now proposed to be generally acquiesced in, the law of priority would doubly sanction the retaining as *Glycine* a species of the elder Linnæus in preference to one of his son's, and the adoption of Swartz's separate genus in preference to Mœnch's. To *Glycine* as thus limited must be referred my *Leptolobium* or *Leptocyamus*. As Australian, and as having been formerly published under *Kennedya*, it only occurred to me at the time, with the limited materials then at my disposal, to compare it with that genus, more especially as the flowers are usually solitary under each bract, not clustered two or three together as in Arnott's *Johnia*; but this character is accompanied by no other one, is not always constant, and appears wholly insufficient to be considered as otherwise than sectional where the habit is so very similar.

The genus *Teramnus*, Sw. (*Glycine*, W. & Arn.), of which I have given a detailed character in Martius's 'Flora Brasiliensis,' comprises the four or five following species.

1. T. VOLUBILIS, *Swartz*. Foliolis oblongis lanceolatisve subtus sericeis pubescentibusve, calycis labio superiore brevissime bidentato, vexillo basi angustato, alis utrinque angulato-dentatis carina subduplo longioribus, legumine adpresse piloso.

*Hab.* Tropical America.

2. T. UNCINATUS, *Swartz*. Foliolis oblongis lanceolatisve vel imis ovatis subtus sericeo-villosis, calycis laciniis 5 æqualibus, vexillo basi angus-

tato, alis obtuse unidentatis carina duplo longioribus, legumine dense villoso.

*Hab.* Tropical America and Mexico.

The synonymy and a detailed description of the above two species are given in Martius's 'Flora Brasiliensis,' Papilionaceæ, pp. 137, 138.

3. T. LABIALIS, *Spreng. Syst.* ii. 235. Pube adpressa vel in inflorescentia patente, foliolis ovatis oblongisve, calycis labio superiore profunde bifido, vexillo basi angustato, alis unidentatis carina triente longioribus, legumine adpresse piloso vel glabro.

Very widely spread over the warmer regions of Africa and Asia. See the description and synonymy given under *Glycine labialis*, Linn. f., by Wight and Arn. Fl. Penins. Ind. Or. p. 208, to which may be added also the following synonyms:—*Glycine Warreensis*, Dalz. in Hook. Kew Journ. iii. 210; *G. senegalensis*, DC. Prod. ii. 242; *G. abyssinica*, Hochst., A. Rich. Fl. Abyss. i. 212 (*Kennedya arabica*, Hochst. et Steud. Pl. Exs.); *Bujacia gampsonychia*, E. Mey. Comm. Fl. Afr. Austr. 127; *Glycine gampsonychia*, Walp. in Linnæa, xiii. 533.

4. ? T. MOLLIS, *Benth.* Foliis subtus sericeis, inflorescentia patentim pilosa, calycis labio superiore bidentato, vexillo basi rotundato, alis unidentatis carina triente longioribus, legumine longe piloso.—Glycine mollis, *Wight et Arn. Prod. Fl. Penins.* 208 (ex parte).

*Hab.* Indian peninsula, Ceylon, Prome.

Some of the specimens included by Wight and Arnott under *G. mollis*, especially those of the Courtallum collection, n. 221, appear to me to be a variety only of *T. labialis*; but the majority, including those of the Courtallum collection, n. 222, may possibly be really distinct, in the upper lobes of the calyx united nearly to the top and a differently shaped vexillum.

5. T. FLEXILIS, *Benth.* Glabrescens, foliolis ovatis amplis, racemis brevibus confertifloris, calycis dentibus 5 tubo brevioribus, legumine glabro.—Glycine flexilis, *Wall. Cat. Herb. Ind.* n. 5521.—Caules alte volubiles, retrorsum pilosi, demum glabrati. Foliola 4–5 poll. longa, 2–3 poll. lata, utrinque glabra vel subtus pilis raris præsertim ad venas conspersa. Racemus fructifer petiolo brevior. Legumina pleraque 3 poll. longa, 2 lin. lata, plano-compressa, apice breviter uncinata.

*Hab.* Silhet and Assam, *Wallich, Jenkins.*

This species is at once distinguished by the large size of all its parts. The specimens are all past flower, and I have not seen the petals; but the persistent calyx and stamens, with the alternate anthers reduced to small capitate staminodia, and the hooked pod leave no doubt as to its genus.

Of the genus *Glycine* as I propose to limit it, and of the six species of the section *Leptolobium*, characterized by the flowers distinct from each other, not clustered along the rhachis, full characters are given in my 'Flora Australiensis,' ii. 242. Besides these, the genus would include five others, characterized as follows.

Sect. *Soja.* Flores fasciculati. Legumen latiusculum, rectum vel falcatum, inter semina non depressum.

1. G. SOJA, *Sieb. et Zucc. Fam. Nat. Fl. Japon.* ii. Villosa, floribus fasciculatis, inferioribus axillaribus, racemis superioribus folio brevioribus, corolla calyce pæne dimidio longiore, legumine latiusculo falcato 2–3-spermo.—Soja hispida, *Mœnch, DC. Prod.* ii. 396.

Cultivated; and spontaneous on the margins of fields and cultivated places over a great part of tropical Asia.

2. G. HEDYSAROIDES, *Willd., DC. Prod.* ii. 241. Molliter pubescens, floribus axillaribus fasciculatis, corolla calyce pæne dimidio longiore, vexillo pubescente, legumine leviter falcato 5–6-spermo.—Johnia Willdenowii, *Hook. f. Fl. Nig.* 305; Teramnus hedysaroides, *Spreng. Syst.* iii. 235.

*Hab.* W. tropical Africa, *Thonneig, G. Don,* and others.

3. G. PENTAPHYLLA, *Dalz. in Hook. Kew Journ.* iv. 344. Sericeopuberula vel glabrescens, foliolis sæpius 5, floribus in racemo elongato fasciculatis, calyce basi obtuso, dentibus brevissimis, ovario sub-4-ovulato, legumine obliquo vel subfalcato.

*Hab.* Concan, *Dalzell, Stocks*; Khasia, *J. D. Hooker and Thomson.*

4. G. LYALLII, *Benth.,* sp. n. Pubescens vel rufo-villosa, foliolis 5–7, floribus in racemo elongato fasciculatis, calyce basi postice gibbo, laciniis tubo vix brevioribus, ovario 6–8-ovulato, legumine rectiusculo.—Caules tenues, volubiles. Foliola nunc ovata, terminali subpollicari, lateralibus minoribus, nunc lanceolata, terminali sæpe 2-pollicari vel longiore. Racemi axillares 2-pollicares et longiores. Flores per 2–5 fasciculati, magnitudine eorum *G. javanicæ.* Pedicelli raro lineam longi. Petala 3-lin., glabra; vexillum a cæteris remotum, ungue incurvo calycis tubum æquante; alæ et carina oblongæ, vexillo subæquilongæ. Legumen 3–4 poll. longum, 4–5 lin. latum, rectum vel leviter falcatum, cuspidatum. Semina 4–6, transverse oblonga.

*Hab.* Madagascar, *Lyall, Bréon.* Province of Emirna, *Bojer.* Island of Ambongo, off the coast, *Perville.*

Sect. *Johnia.* Flores fasciculati. Legumen rectiusculum, demum transverse inter semina depressum.

5. G. JAVANICA, *Linn., DC. Prod.* ii. 242. Villosa, racemis folio longioribus, floribus fasciculatis, corolla calyce dimidio longiore, legumine 3–6-spermo lineari rectiusculo inter semina transverse lineato.—Johnia Wightii, *W. et Arn. Prod. Fl. Penins.* 449; Soja javanica et S. Wightii, *Grah. in Wall. Cat.* n. 5528, 5530; Bujacia anonychia, *E. Mey. Comm.*

*Pl. Afr. austr.* 127; Glycine moniliformis et G. micrantha, *Hochst. in A. Rich. Fl. Abyss.* i. 211 & 212.

*Hab.* Eastern Africa from Natal to Abyssinia, Ceylon and the Indian peninsula, including the specimens from Nilgherri, *Hohenacker*, n. 1594, distributed by some mistake on my authority under the name of *Shuteria vestita*.

*Johnia Petitiana*, A. Rich. Fl. Abyss. i. 210, t. 40, *Soja angustifolia*, Miq. Fl. Ind. Bat. i. part 1. 223, and *S. hamata*, Miq. l. c. 224, are unknown to me.

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## On a new Genus of *Ternstrœmiaceæ*. By Captain R. H. BEDDOME, Officiating Conservator of Forests, Madras. Communicated by Dr. T. THOMSON, F.L.S.

[Read November 17, 1864.]

[PLATE XVII.]

### PŒCILONEURON.

Calyx 5-parted, divisions equal, imbricate; petals 5, contorted. Stamens about twenty on a tube surrounding the base of the ovary, which is either inconspicuous and entire or more prominent and 5-cleft so that the stamens are subpentadelphous; anthers erect, affixed by their base, long, linear. Styles 2, stigmas filiform. Ovary 2-celled; ovules 2 in each cell, erect. Capsule not known. Panicles terminal. Leaves opposite, with close parallel venation, minutely reticulated.

P. INDICUM (Beddome). A tree. Leaves ovato-oblong, with a long acumination, glabrous; panicles terminal, many-flowered; flowers yellowish white; calyx, peduncles, and pedicels slightly puberulous.

Western slopes of the Nilgiris; 3000 feet elevation. A large tree, said to yield a valuable timber.

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## On the Naturalized Weeds of British Kaffraria. By W. S. M. D'URBAN, Esq., F.L.S. In a letter to Dr. HOOKER, V.P.L.S.

[Read November 17, 1864.]

Newport, near Exeter,
Nov. 3, 1864.

MY DEAR DR. HOOKER,—You asked me last spring to draw up a Note on the Naturalized Weeds of British Kaffraria, and I fully intended to have complied with your request long ere this. I have, however, been so incessantly occupied with my Botanical Classes in Exeter and other engagements, that I have been unable until very recently to spare the time necessary to look up my notes on Kaffrarian botany dispersed through my journals. I hope the following notes will not be too late to be of some slight service to you. You must remember, in extenuation of the scantiness of my list of weeds and the small amount of information I have to supply you with, that I was resident only twelve months in the colony of British Kaffraria, and my time was mainly occupied with the Filices amongst plants and the Rhopalocera amongst insects, and their pursuit necessarily took me away a good deal from the neighbourhood of European cultivation, where alone, in a new colony, intrusive weeds are likely to be met with, though in the case of some few remarkably prolific and hardy species the whole country may be overrun by them.

I also suffered from the want of botanical works, Harvey's 'Genera of South African Plants,' Asa Gray's 'Manual of the Botany of the Northern and Midland States of America,' and Lindley's 'School Botany' being the only ones to which I had access.

British Kaffraria is still but an infant colony. King William's Town, the capital, was founded only about twenty-eight years since, and it was abandoned for some years, or until the Kaffir war of 1848, when it was again taken possession of by the British Government. The Rev. J. Brownlee, the first Missionary to the Kaffirs who succeeded in establishing himself amongst them, being an enthusiastic botanist and gardener, introduced most of the more valuable cultivated plants now growing at King William's Town, long before the province had been taken possession of by our troops. British Kaffraria is situated on the south-eastern coast of Africa, between the Keiskamma and Great Kei Rivers. King William's Town is 25 or 30 miles in a straight line from the sea-coast, and is in lat. 32° 52′ S., long. 27° 20′ E. The winter, from April to September, is the dry season, when rain rarely falls, and frosty nights occur occasionally. The summer is generally very wet, with frequent violent thunder-storms and sudden changes of temperature. I should not have made the few notes subjoined, had not the subject of the intrusion of weeds occupied my attention when exploring with Sir William Logan in the backwoods of Canada, where I was greatly interested by the gradual advance of the weeds accompanying European immigration into the very heart of the forests. They already form at least one-tenth of the somewhat scanty flora of the Laurentian rocks north of the Ottawa wherever a settlement has been formed, and all along the banks of rivers which lumber-men have ascended, their seeds being dropped on the ice from the hay supplied to the horses employed in the winter traffic.

Most of the species I have enumerated in the annexed "List of Naturalized Intrusive Plants found in British Kaffraria" are thoroughly established and spreading with great rapidity, all of them freely increasing by seed. Indeed the luxuriance and prolificness of the garden weeds forced itself on my attention. For a short time after my arrival at King William's Town I occupied myself a good deal with gardening; but as the summer came on, it seemed such a hopeless task to keep down the weeds which choked the cultivated plants, that I abandoned the attempt in despair. In British Kaffraria amateur gardening soon succumbs to the droughts in winter and the weeds in summer.

I have not thought it advisable to include in my list certain garden flowers, such as *Eschscholtzia Californica*, *Œnothera biennis*,

*List of Naturalized Intrusive Plants found in British Kaffraria.*

| Name of Plant. | Where found. | Duration. | Original native country.* |
|---|---|---|---|
| *Fumaria officinalis*, Linn. | Cultivated ground. | Annual. | Europe. |
| *Viola tricolor*, Linn. | Gardens. | " | |
| *Stellaria media*, Linn. | " | " | |
| *Malva parviflora*, Linn. | Waste places. | Perennial. | South of Europe. |
| *Hibiscus Trionum*, Linn. | Gardens, &c. | Annual. | |
| *Tribulus terrestris*, Linn. | " | " | |
| *Medicago denticulata?*, Willd. | " | " | Europe. |
| *Vicia sativa*, Linn. | " | " | |
| *Agrimonia Eupatoria*, Linn. | Roadsides. | Perennial. | |
| *Portulaca oleracea*, Linn. | Gardens. | Annual. | |
| *Xanthium spinosum*, Linn. | Roadsides, &c. | " | Trop. America? |
| *Bidens bipinnata?*, Linn. | Gardens. | " | N. America. |
| *Sonchus oleraceus*, Linn. | " | " | Europe. |
| *Anagallis arvensis*, Linn., var. *cærulea* | Waste ground. | " | |
| *Nicandra physaloides*, Gaertn. | Gardens. | " | S. America. |
| *Physalis pubescens*, Linn. | Gardens, waste places, and forests. | Perennial. | Trop. America. |
| *Solanum nigrum*, Linn. | Gardens. | Annual. | Europe. |
| *Datura Stramonium*, Linn. | Gardens and waste places. | " | Trop. America. |
| —— (species) | Gardens. | " | ? |
| *Chenopodium album*, Linn. | " | " | Europe. |
| —— *Botrys*, Linn. | " | " | South of Europe. |
| —— (species) | Waste places. | Perennial. | ? |
| *Amaranthus albus*, Linn. | Gardens. | Annual. | Trop. America. |
| —— *hypochondriacus*, Linn. | " | " | |
| *Polygonum aviculare*, Linn. | Waste places. | " | Europe. |
| *Emex spinosus* | Gardens. | " | S. Europe and N. Africa. |
| *Ricinus communis*, Linn. | Cultivated ground. | " | Asia. |
| *Urtica urens*, Linn. | Gardens. | " | Europe. |
| *Panicum verticillatum*, Linn. | " | " | |
| —— *glaucum*, Linn. | " | " | |
| *Cynodon dactylon*, Pers. | Waste places. | Perennial. | |
| *Hordeum murinum*, Linn. | " | " | |

*Zinnia elegans*, *Mirabilis Jalapa*, *Ipomœa purpurea*, and *Canna Indica* (which spread themselves rapidly over gardens and become weeds where they have once been sown), because they are not generally diffused. Of the Morning Glory or *Ipomœa* at least four crops come up in the season; and its voluble habit renders it a most unwelcome plant in a flower-garden, in spite of its exquisitely beautiful flowers of every hue. It speedily smothers everything else, and from its rapid growth is most exhaustive to the soil.

You will see that, with the exception of five species, namely *Malva parviflora*, *Tribulus terrestris*, *Emex spinosus*, *Ricinus communis*, and *Hordeum murinum*, and two species whose original habitats are unknown to me, the whole of the thirty-two plants in my list are found in North America either native or naturalized, and many of them may therefore have been introduced from thence with the American garden seeds which are so largely imported into South Africa. Indeed this is the popular view of their origin in the colony itself. *Tribulus terrestris* and *Emex spinosus* are perhaps native weeds.

The *Fumaria* is that form of *officinalis*, Linn., called var. *Capensis*, and supposed by Dr. Sonder to be identical with *F. muralis* of the 'Flora Germanica.'

The *Medicago* has two to three coils in the pod, and is probably *denticulata*, Willd.

The Common Purslane (*Portulaca oleracea*) spreads itself in dense mats over the gardens in an astonishing manner. It is not, I think, generally known in England that the South African antelopes do not eat grass, but live entirely on succulent shrubs and bulbs. A tame Duiker Bok (*Cephalophus Grimmia*) confined in our garden at King William's Town previously to my arrival there had been fed principally upon "Spell-boom" or Tree-Purslane (*Portulacaria Afra*), a dwarf state of which is used as an edging to the flower-beds, but knowing its affinity with the Garden Purslane, I was induced to offer the latter to the Duiker, which ate it with great avidity. Might not this hint be useful to the authorities of the Zoological Gardens, who do not seem to have hitherto been particularly successful in the management of their South African antelopes, judging from the numerous deaths which have occurred amongst Sir George Grey's magnificent donations?

The Thorny Clotbur (*Xanthium spinosum*) has spread with such rapidity along the roadsides, around the military posts, and in all waste places, as to occasion great alarm amongst the sheep-farmers and others interested in the wool trade, the prickly involucre forming the "bur" adhering to the fleece of any sheep coming into contact with it. Great exertions were being made when I left the colony in 1861 to exterminate this vile weed, which it was thought would greatly deteriorate the staple product of the country.

The Bur Marigold (*Bidens bipinnata*) is a most troublesome and annoying garden weed. It grows in great profusion, and reaches the height of several feet. Hardly anything can compete with it, except that equally vile and irritating plant the Bristly Foxtail Grass (*Panicum* (*Setaria*) *verticillatum*). These two weeds are enough to break the heart of a gardener; they grow and spread with such vigour and rapidity, that it is almost impossible to cope with them. The barbed awns on the achenia of the *Bidens* and the bristles of the spikelets of the *Setaria* alike pertinaciously adhere to one's clothes and are difficult to get rid of. The *Bidens* seemed to me to be *bipinnata*, but may possibly be some other species unknown to me.

*Nicandra physaloides* and *Solanum nigrum* are abundant in gardens. The soldiers stationed in the colony often eat the black berries of the latter, and they appear to be quite innocuous.

The well-known "Cape Gooseberry" (*Physalis pubescens*) was introduced about 40 years since into his garden at King William's Town by the Rev. J. Brownlee. It has spread in a wonderful manner, and by the agency of birds has been carried to the beautiful forests which fill the gorges or "Poorts" in the Buffalo Mountains about fourteen miles from King William's Town, and it has firmly established itself all along the lumber-roads made through the forest. The Fingoe women collect the smooth yellow berries and bring them to the markets for sale. They make a delicious preserve.

The Thorn Apple (*Datura Stramonium*) is a very disagreeable intrusive plant, not only from its heavy disgusting odour, but from its rank growth. There are two varieties equally common in gardens and waste places near houses. One variety has pale green stems and white flowers, and the other has the stems deep reddish purple and the flowers tinged with lilac. The latter I have seen 6 feet high in the soldiers' gardens at Tylden Post, about 70 miles north of King William's Town. It is probably the *D. Tatula*, Linn.

*Datura*, sp. I have not been able to ascertain the name of this species. It is a much-branched, strongly smelling annual, about 3 feet high, covered all over with viscid pubescence, and scurfy. Leaves opposite, or a leaf on one side of the stem and a branch on the other, on long petioles, entire, ovate, subcordate at the base; base unequal. Flowers on short pedicels in the forks of the branches, erect, solitary; calyx 4 inches long, inflated, bilobed; corolla longer than the calyx, 5-plaited, -angled, and -pointed, pure white, sweet-scented. Stamens distinct; anthers not coherent round the style. Flowers from December to February, opening only in the evening or in cloudy weather, and is common in gardens.

The *Chenopodium* which I have left unnamed grows in the greatest profusion in every waste place about King William's Town. Its odour is exactly that of chloride of lime. It is a woody much-branched perennial with a leaf like that of *C. Botrys*, Linn. I am quite unable to discover its name. The native *C. Caroxylon*, Thbg., comes up in immense quantities on the sites of old Kaffir kraals and gives forth a most offensive odour. There are several weeds not mentioned in my list which are common in the western districts of the Cape Colony and about Graham's Town, but which I did not observe in Kaffraria; and I do not think they have yet penetrated there. These are *Capsella Bursa-pastoris*, *Erodium moschatum*, and *Oxalis corniculata*.

The Prickly Pear (*Opuntia vulgaris*, Mill.) was introduced during the Kaffir war of 1836 into Kaffraria as a means of defence against the natives; and it grows very freely, having become almost naturalized about old military posts. It is not so abundant as supposed, however; for many persons confound it with the tall prickly Euphorbias so characteristic of the Kaffrarian flora.

Amongst native plants which are met with about gardens as weeds I may mention *Lepidium myriocarpon* and a species of *Aizoon*.

A *Plantago* is common by roadsides and in waste places, but I do not know to what species it should be assigned.

Two species of *Commelyna*, the one with bright blue and the other with buff-coloured flowers, are complete weeds in damp places about houses and military posts. They are, I suppose, native species.

The Common Watercress has been introduced into the water-course which supplies the garrison with water at King William's Town, and is fairly established there.

Should these imperfect notes prove of any service to you, I shall feel flattered by your making any use you please of them.

Believe me, my dear Dr. Hooker,

Very truly yours,

W. S. M. D'Urban.

## Note on the Variety *Trimmeri* of *Potamogeton trichoides*, Cham., found in England. By ROBERT CASPARY, Professor of Botany, Königsberg, Prussia. Communicated by Dr. HOOKER, V.P.L.S.

[Read December 15, 1864.]

AMONGST the Potamogetons of my herbarium is one, collected by my friend the Rev. Mr. Trimmer, of Norwich (Sept. 1850), in a pond near Framingham Earl, Norfolk, which I do not find mentioned in those British Floras I have at hand (Eng. Bot. cum Suppl.; Babington, Manual, 1843; Hook. & Arnott, Brit. Fl. 1850*), and which therefore may perhaps be new to England—*Potamogeton trichoides*, Cham. (Linnæa, 1827, ii. 275). I received this plant from Mr. Trimmer himself during my two years and a half's stay in England. It is not that variety of this species which Chamisso described and figured (*l. c.* tab. 4. fig. 6), and which was also represented by Reichenbach (Icon. Fl. Germ. 1845, vii. t. 21), and named by Ascherson (Fl. der Mark Brandenburg, 665) (*b*) *leiocarpus*, having only under the middle of the interior margin of the caryopsis a large tubercle, and a smooth carina ("fast ganzrändigen Kiel," Aschers.); nor is it that form which Fieber (Die Potamogetonen Böhmens: Prag, 1838, tab. 4. fig. 22) knew, and which Reichenbach mentions as *P. trichoides β. tuberculosus* (*l. c.* tab. 22. fig. 35); but it is a form intermediate between these two. The caryopsis of Fieber and Reichenbach's plant, *P. trichoides β. tuberculosus*, Reichenb., has a tubercled carina, and a large tubercle on either side of its base under the tubercle of the interior margin†. But the plant of the Rev. Mr. Trimmer, although it has well-defined tubercles on the back of the caryopsis, has no lateral tubercle below that of the interior margin. I designate this form as *P. trichoides* var. *Trimmeri*.

Königsberg in Pr.,
26 Nov. 1864.

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[* The station for this plant near Norwich is given in the 7th edition of Hooker and Arnott's 'British Flora' (1855) and in the 4th edition of Babington's 'Manual' (1856). Dr. Caspary's critical notes, however, appear to be of sufficient interest to be placed on record.—ED.]

† It is possible that "*Potamogeton tuberculatum*," Tenore et Gussone (Memorie sulla Peregrinazione, lette alla R. Accad. delle Scien. 1834–38, Napoli, 1842, p. 150; Tenore, Sylloge, App. v., Napol. 1842, p. 4), which Ascherson, *l. c.*, unites with his *P. trichoides α. tuberculatus*, is synonymous with *P. trichoides β. tuberculosus*, Reichenb., as the caryopsis is represented "tuberculo unico utrinque" (Tenore, Syll. *l. c.*) and "ad carinam plurituberculata" (Ten. et Guss. Mem. *l. c.*); but as the leaf is described as "obtusiusculum" and the caryopsis as "obsoleto reticulato-nervosa" (Ten. et Guss. *l. c.*), which is never found in *P. trichoides*, Cham., I cannot decide the question without seeing an

## Extract of a letter from Professor W. H. Brewer, State Geological Survey of California, on the Forests of *Sequoia* (*Wellingtonia*) *gigantea*, addressed to Sir W. J. Hooker, F.R.S. & L.S.

[Read January 19, 1865.]

An interesting discovery this year has been of the existence of the big trees in great abundance on the western flanks of the Sierra Nevada, in about lat. 36° or 37°. They are very abundant along a belt at 5000–7000 feet alt., for a distance of more than twenty-five miles, sometimes in groves, at others scattered through the forests in great numbers. You can have no idea of the grandeur they impart to the scenery, where at times a hundred trees are in sight at once, over 15 feet in diameter, their rich foliage contrasting so finely with their bright cinnamon-coloured bark. I found trees larger than they occur further north (in the Calaveras and Maipura groves). The largest tree I saw was 106 feet in circumference at 4 feet from the ground. It had lost some buttresses by fire; it must have been at least 115 or 120 feet when entire; it is 276 feet high. The Indians tell of a much larger tree which I did not see.

There seems no danger of the speedy extinction of the species, as it is now known in quite a number of localities, and, contrary to the popular notion, there are immense numbers of younger trees of all sizes, from the seedling up to the largest. There has been much nonsense and error published regarding them.

I have no doubt of the true generic relations. I think that no one who is familiar with both species *in situ* would separate them generically from the *Sequoia sempervirens*, also abundant in this State, and fully as restricted in its distribution; nor do I think the names of *Wellingtonia* and *Washingtonia* would be insisted on with such zeal, were it not for seed-dealers and plant-collectors. I may remark that the seed-collectors on this coast have created endless confusion by naming species more for *profit* than from any honest conviction that they were new species.

I enclose a photograph by Watkins of the "Grizzly Giant," the largest tree in the "Maipura Grove" of Sequoias. It is a very characteristic tree, and is about 87 feet in circumference at 3 feet from the ground. During the past summer some fine photographs have been taken of the "Calaveras" big trees—the first-discovered grove.

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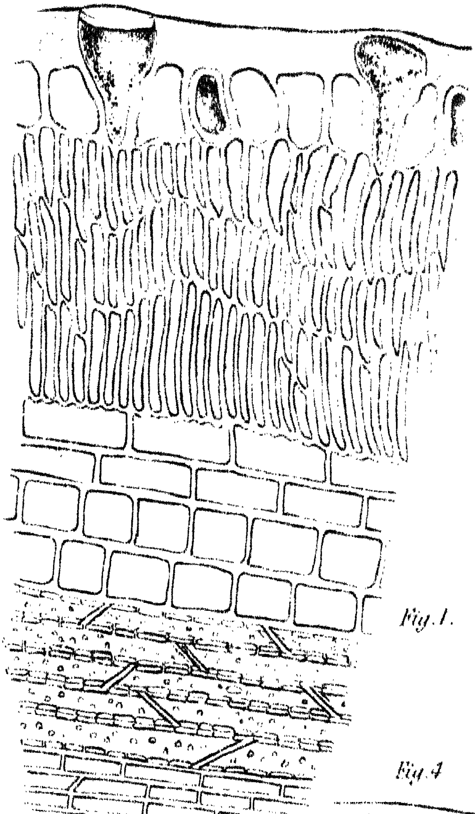
original specimen of *P. tuberculatus*, Ten. et Guss. The representation of this plant, which according to Tenore and Gussone is given by Boccone (Sic. p. 41, tab. 20. fig. 5), is so bad that it can only be guessed at, not determined.



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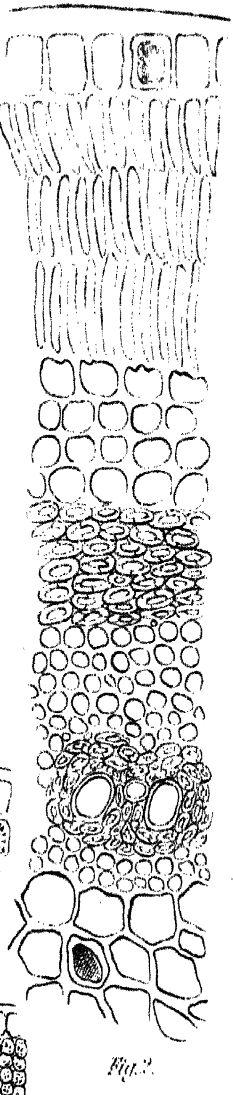

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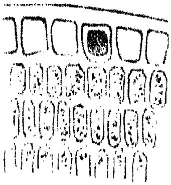

Fig. 4

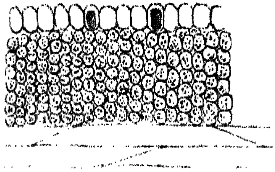

Fig. 3.

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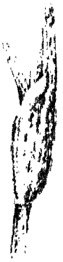
Vincent Brooks, Imp.



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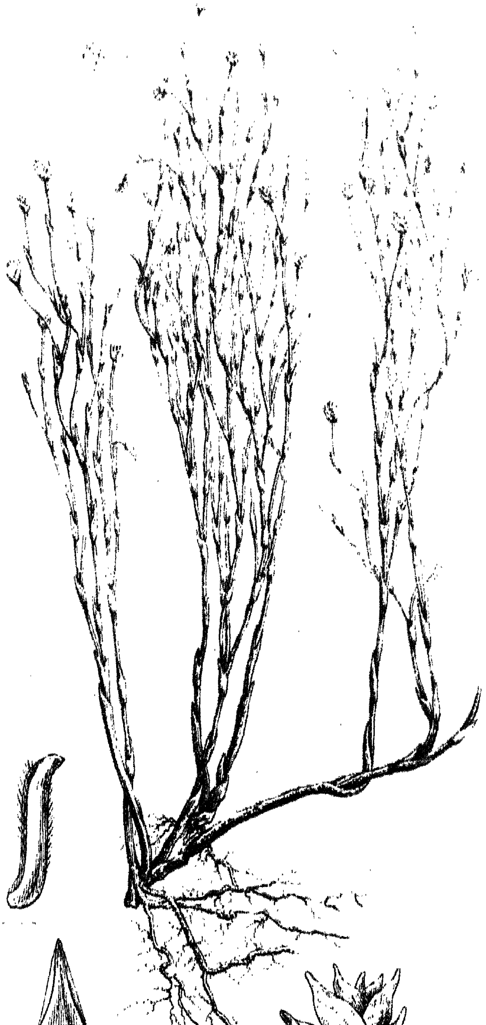

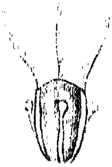

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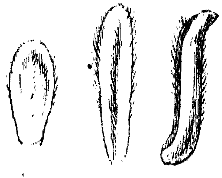

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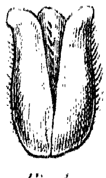

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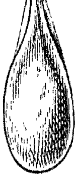

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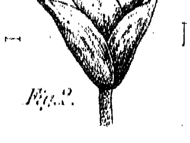
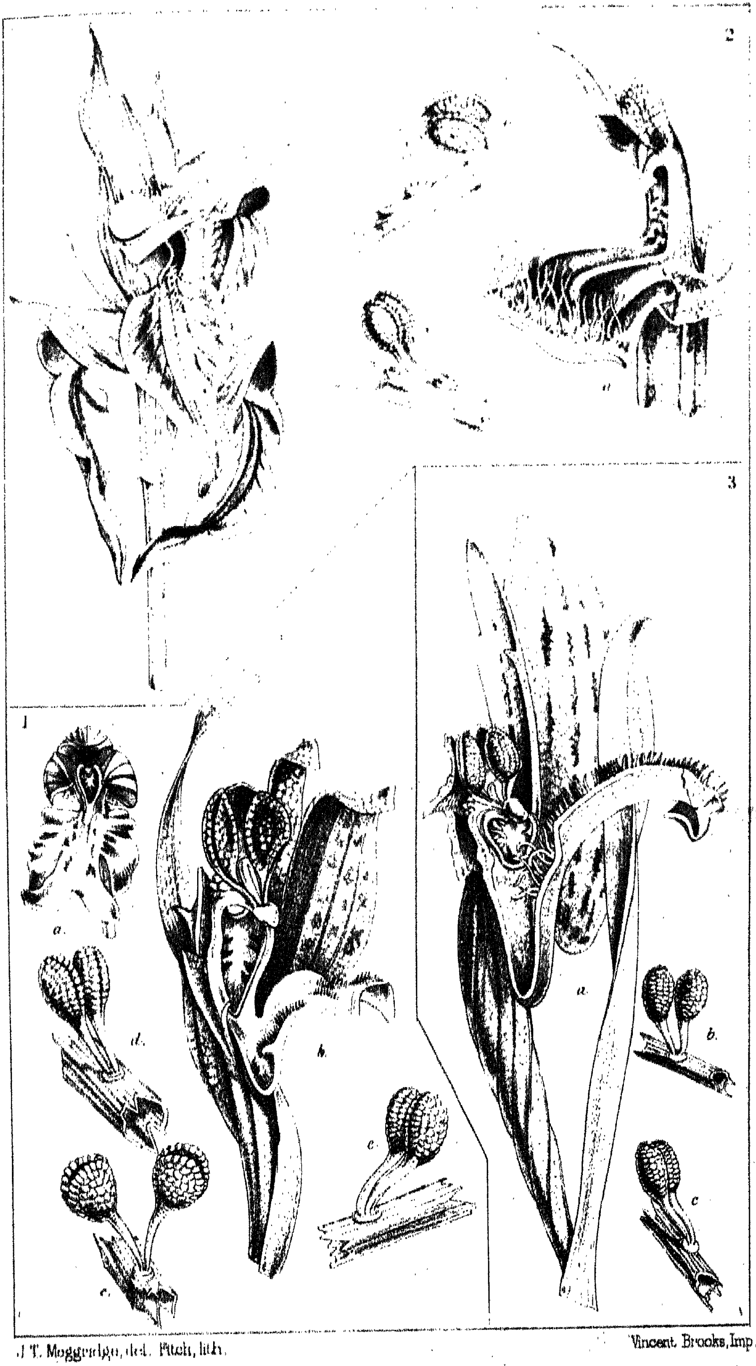
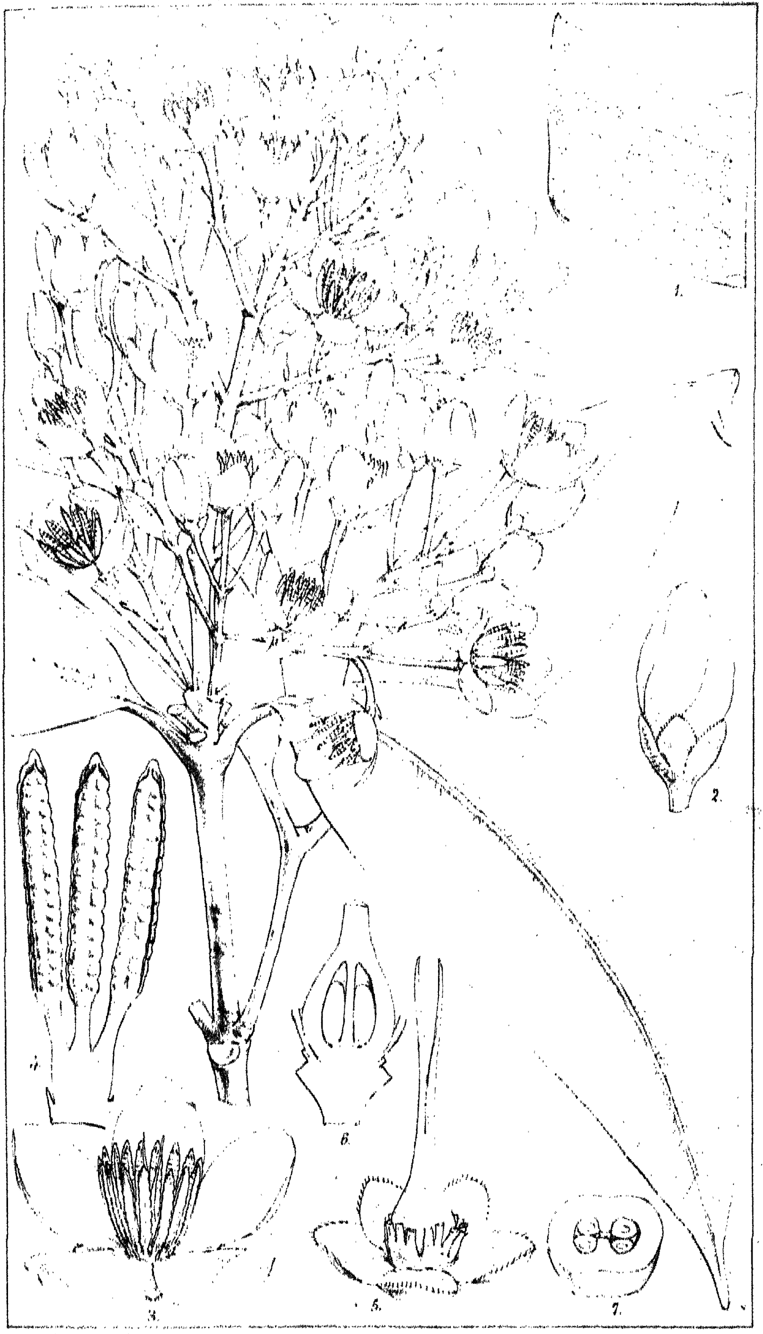


Fig. 2.

E. M. Williams, del. ad nat., M. T. Maund. Vincent Brooks, Imp



J. T. Moggridge, del. Fitch, lith.
Vincent Brooks, Imp.



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